School of Marketing

Green Supply Chain Antecedents, Practices, and Firm Performance in the Australian Food Industry

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DECLARATION

To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgement has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature: …… …… ……

Azadeh Rajabian Tabesh

December 2018

DEDICATION

Dedicated to My Beloved Family

My lovely parents: Reza and Hamideh

My husband: Dr Omid Ameri Sianaki

My beautiful soul: Ario

My sister: Donya

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In the name of God, the Most Gracious and the Most Merciful.

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LIST OF ABBREVIATIONS

$A	Australian dollar
ABS	Australian Bureau of Statistics
AHP	analytic hierarchy process
AVE	average variance extracted
B2B	business-to-business (market)
BAR	barrier
BF	benefit
bn	billion
BUY	buyer
CP	cleaner production
CR	composite reliability
DEMATEL	Fuzzy Decision-Making Trial and Evaluation Laboratory
EMS	environmental management system
ENVPE	environmental performance
EPA	Environmental Protection Agency (US)
EXDET	external determinant
FINPE	financial performance
GDP	gross domestic product
GHGs	greenhouse gases
GOV	government
GP	green purchasing
GSC	green supply chain
GSCM	green supply chain management
GSCP	green supply chain practice
IChemE	Institution of Chemical Engineers
INTD	internal supply determinant
IR	internal supply relationship
ISO	International Organization for Standardization
IT	institutional theory
LISREL	linear structural relations (software)
NGO	non-governmental organisation
NPD	New Product Development (job title)
NRBV	natural resource-based view
OPPE	operational performance
PE	performance
PLS	partial least squares
PLS-SEM	partial least squares-based structural equation modelling
RBV	resource-based view

SC	supply chain
SCM	supply chain management
SEM	structural equation modelling
SPSS	IBM SPSS Statistics
SUP	supplier
TQEM	total quality environmental management
TQM	total quality management
UK	United Kingdom
UN	United Nations
UNCSD	United Nations Commission on Sustainable Development
US/USA	United States/United States of America
WCED	World Commission on Environment and Development

ABSTRACT

Green supply chain management (GSCM) is the focus of growing attention in both academic and non-academic fields. Researchers are therefore increasingly focused on the different aspects of GSCM, with this including identifying its influential antecedents such as external and internal determinants, as well as detecting green supply chain practices (GSCPs) and investigating the impacts of GSCM on firm performance. However, the existing literature on GSCM lacks a thorough empirical validation of the relationships between these factors. With this as its backdrop, the current study thus aimed to develop a comprehensive model to understand the relationships between GSCM antecedents, GSCPs and, in turn, firm performance.

Based on an extensive literature review, the current study developed a conceptual framework, with this justified through the lenses of institutional theory (IT) and the resource-based view (RBV). Following a positivist research paradigm, this study adopted a quantitative method research design. The research model comprised four main constructs which involved both reflective and formative measures. To test the theoretical relationships in the hypotheses, the study applied partial least squares (PLS)-based structural equation modelling (SEM). Survey data were collected from 136 Australian food directors and managers in three groups of firms: environmental management system (EMS)-certified firms; firms in the process of implementing environmental management systems (EMSs) and firms without environmental management systems (EMSs). Survey data were collected from the study sample using a structured questionnaire, with respondents recruited by applying a selective sampling technique. The data were analysed via PLS-SEM for the 52 respondents who had EMSs in their firms. For the other two groups, those without EMSs and those in the process of implementing EMSs, the barriers to implementing EMSs and the benefits of implementing EMSs were respectively analysed, using SPSS.

The research results revealed that the internal supply determinants that positively impacted on GSCM were agility and internal supply relationships. The other GSCP antecedents, namely, the external determinants of government support and buyer

participation, were also shown to have a key role in the effective development of green supply chain practices (GSCPs). The study results showed that the main GSCP dimensions, namely, total quality management (TQM), environmental management systems (EMSs) and green purchasing significantly enhanced the performance of food production firms in terms of their environmental, economic and operational dimensions. The significant research result was that the external determinants of government support and buyer participation positively impacted on the internal supply determinants of agility and internal supply relationships. The study also found that the positive impact of external determinants on GSCPs through the mediated role of internal supply determinants was indirect and weak.

This study has made both theoretical and practical contributions. Modelling the relationships between external determinants (EXDETs) and internal supply determinants (INTDs) and their impacts on green supply chain management (GSCM) as well as developing an understanding of GSCM's influential role in firm performance in a single framework is, to date, a unique initiative in the literature. Thus, this research enriches the body of knowledge in the GSCM literature. The factors and variables from this research will assist Australian food directors and managers to identify significant green antecedents and will assist them to effectively deal with these antecedents. Directors and managers will be assisted in their understanding of how to engage with green practices, in terms of EMSs, total quality management system (TQM) and green purchasing, to develop firm performance in terms of the environmental, operational and economic aspects. The study implications are also significant for other countries with a similar industrial context. Firm directors, managers, stakeholders, policy makers and governments may follow the study's outcomes and focus on developing GSCPs with a view to achieving superior organisational performance. It is hoped that this study will encourage Australian firms to look at the GSCP antecedents and GSCP capabilities with a view to improving firm performance.

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

The integration of environmental activities into supply chain management (SCM) is recognised as a significant strategic issue in achieving business success (Longoni and Cagliano, 2018; Green et al., 2012). In this respect, the concept of the green supply chain (GSC) has been developed as a novel approach with the aim being for the firm to survive tough environmental regulations and to meet market expectations (Ali et al., 2017; Seman et al., 2012). Moreover, it is important to note that applying green principles and capabilities in isolation is improbable as the firm's decision to implement GSCM fundamentally depends on influential external and internal drivers (Wu et al., 2015; Ali et al., 2017).

Attempts to identify the external determinants of GSCPs have attracted much debate (Lo and Shiah, 2016; Lee, 2008; Walker, Di Sisto, and McBain, 2008; Zhu, Sarkis and Lai, 2008). However, little research has been conducted on which external determinants impact on which specific GSCPs, through detailed investigation using a multidimensional model. For example, although past studies, such as the work of Lin and Ho (2011); Wu, Ding and Chen (2012); and Lo and Shiah (2016), have concentrated on the relationships between external determinants and GSCPs, multidimensional comprehensive model was not use. The current research therefore attempts to fill this gap by modelling a multidimensional framework to assess the effect of external determinants on specific green supply chain practices (GSCPs).

This study's other important aim is to understand the relationships between internal supply determinants in the development of green supply chain practices (GSCPs). Many studies in the literature have focused on the impact of internal organisational determinants, such as management commitment, trust and employee commitment, on GSCP development (Simpson, Power and Samson, 2007; Mohanty and Prakash,

2014; Gold, Seuring and Beske, 2010). Nevertheless, research is scarce on the relationships between internal supply determinants, namely, agility and internal supply relationships, in relation to developing the GSC in the business-to-business (B2B) market (Hassan et al., 2016 and Hoejmose, Brammer and Millington, 2012). Hence, the current research aims to determine the relationships between internal supply determinants and their effect on GSCPs through a multidimensional model.

Another important gap in the literature is the lack of research seeking to gain an understanding of the indirect relationships of external determinants with GSCPs through internal supply determinants. The current study seeks to fill this gap by developing a multidimensional model to investigate the indirect relationships of external determinants with GSCM through the mediating role of internal supply determinants.

Although a large amount of research has been conducted on the identification of green practices, a very few studies have undertaken a detailed investigation of the features of specific green practices including total quality management (TQM), environmental management systems (EMSs) and green purchasing. Hence, this study attempts to fill a substantial gap in the literature by creating and utilising a multidimensional model to measure the features of these green practices.

Finally, no research has thoroughly examined all the relationships between external determinants, internal supply determinants, GSCPs and firm performance. Therefore, the current study seeks to fill this gap by thoroughly investigating these relationships via the development and utilisation of a comprehensive multidimensional framework and with analysis through the use of SmartPLS software.

This study leads to the development of a conceptual model which explains how various theoretical constructs are interrelated. In this regard, a comprehensive research model is developed based on an extensive literature review. For this study, data were gathered from selected food chains in Australia via a survey of selected participants who were mainly Australian food directors and managers. Quantitative

methodology guided by the positivist paradigm was applied for analysis of the research data (Tashakkori and Teddlie, 2009, p. 25). To collect relevant data, this study distributed a questionnaire to directors and managers in the Australian food industry with the data then analysed using partial least squares (PLS)-based structural equation modelling (SEM) (Barclay, Higgins, and Thomson, 1995, p. 290). The expected outcome from this study was improved knowledge of the influential external determinants and internal supply determinants in relation to GSCPs and firm performance.

The research contributes to the existing GSCM literature by helping future GSC researchers, and specifically those who are interested in the food context. In terms of practical application, the research specifies the importance of government support and buyer participation, emphasising the necessity of establishing a good relationship with them to develop environmentally friendly knowledge and tools to develop their firm's performance.

1.2 BACKGROUND OF THE RESEARCH AREA

Green supply chain management (GSCM) is known as a weapon that is used to achieve the competitiveness of firms (Troisi, 2015). Hence, attention is increasingly being directed towards understanding GSCM's influential (external and internal) determinants and its valuable practices as well as analysing its performance. As GSCM is influenced by various kinds of stakeholders, hence the first important theoretical background for this research is institutional theory (IT) (DiMaggio and Powell, 1983). Based on this theory, stakeholders, in terms of the government and buyers, motivate firms to follow green supply chain management (GSCM). The other important theory for this study is the resource-based view (RBV). According to this theory, intangible supply chain resources enable firms to achieve competitiveness (Barney, 1991). Based on this theory, agility and internal supply relationships were measured in this study as intangible resources in GSCP development. The essential domains of this research, based on the literature review, are described below.

1.2.1 External determinants

The extensive studies in the literature have a rich theoretical foundation on the role of external determinants (EXDETs) in green supply chain practices (GSCPs) (Zhu, Sarkis and Lai, 2013; Wu, Ding and Chen, 2012; Lo and Shiah, 2016). As mentioned above, the relationship between EXDETs and GSCPs is fundamentally supported by an important theory in the GSCM domain, namely, institutional theory (IT) which fundamentally relies on two groups of drivers: coercive and normative (DiMaggio and Powell, 1983). The coercive driver is related to governmental support which is a strong and powerful dimension for creating GSCP innovation (Wu, Ding and Chen 2012; Nezakati, Fereidouni and Rahman, 2016), while the normative driver basically comes from downstream buyers/ customers who face manufacturers' growing environmental expectations to comply with environmental requirements and policies (Hoejmose, Grosvold and Millington 2014). What is noteworthy is that changes in buyer procurement practices directly impact on suppliers' environmental activities and can encourage or force them to become more innovative in their environmental practices (Lee, 2008; Yang, 2017). Overall, external determinants are known as effective green drivers through a variety of governmental and non-governmental stakeholders. The important role of external determinants has been previously mentioned, but significant gaps in this domain remain, as described in the following paragraphs.

Little research has been Little research has been conducted on how different external determinants (EXDETs) impact on specific green supply chain practices (GSCPs) (Sarkis et al., 2016). To fill this gap, the current research conducted a detailed investigation of the role of several EXDETs, namely, suppliers, the government and buyers on specific GSCPs, that is, total quality management (TQM), environmental management systems (EMSs) and green purchasing. The study attempted to fill this gap by investigating external factors through a multidimensional model and with analysis via SmartPLS software.

1.2.2 Internal supply determinants

Internal supply determinants are significant drivers for improving green supply chain practices (GSCPs) (Meqdadi, Johnsen,T. and Johnsen, R., 2017; Hoejmose, Brammer and Millington, 2012; 2016; Khan et al., 2018). The most important theoretical background to support these determinants is the resource-based view (RBV) (Barney, 1991). In reference to this theory, internal supply determinants bring more advantages to a firm by joining together the capabilities, organisational processes and firm-specific attributes, thus enabling the firm to implement strategies with the aim of increasing its competitiveness (Barney, 1991). Two significant intangible supply chain resources are, firstly, internal supply relationships in terms of strong integration, establishing long-length relationships with suppliers and mutual trust (Ndubisi, 2011; Hoejmose, Brammer and Millington, 2012); and, secondly, agility based on the dynamic ability of the firm to respond appropriately to buyer demands (Blome, Schoenherr and Rexhausen, 2013). Simply stated, these dimensions, through their factors, can empower green supply chain practices (GSCPs). This study develops a multidimensional framework to understand the impact of internal supply determinants (INTDs) such as agility and internal supply relationship on green supply chain practices (GSCPs). Also, the mediation role of internal supply determinants between external determinants and green supply chain practices is analysed through a multidimensional framework and using SmartPLS software.

1.2.3 Green supply chain practices (GSCPs)

The GSCM concept is fundamentally formed by integrating environmental considerations into supply chain management (SCM) (Govindan, Khodaverdi and Vafadarnikjoo, 2015). Simply stated, the GSCP philosophy is posited as an emerging management practice that increases eco-industrial competitiveness due to the development of environmental performance (Wu et al., 2015). However, many firms still pay insufficient attention to developing an environmental approach, with this mainly due to their lack of knowledge that the advantages surpass the costs of the implementation of green practices (Montabon, Sroufe and Narasimhan, 2007; Govindan, Khodaverdi and Vafadarnikjoo, 2015). Through applying several green practices, GSCM can influence firm performance and competitiveness (Wu et al.,

2015; Jabbour, A., Frascareli and Jabbour, C., 2015; Youn et al., 2013). As stated by Lo and Shiah (2016): "[a]bout green-related practices, there has not been a unified framework found in [the] literature". Zhu, Sarkis and Lai (2008) emphasised several important practices such as green purchasing, total quality management (TQM) and environmental management systems (EMSs) which were further discussed in later studies (Lo and Shiah, 2016; Laosirihongthong, Adebanjo and Tan, 2013). The current study has relied on the variables selected by Zhu, Sarkis and Lai (2008) which are described in the following paragraphs.

One of the important GSCP measurements is the environmental management system (EMS). The EMS is a strategic management approach which "consist[s] of a collection of internal policies, assessments, plans and implementation actions affecting the entire organisation and its relationships with the natural environment'' (Darnall, Jolley and Handfield, 2008, p. 31). Implementing EMS principles can decrease the negative impact of an organisation's operations on the environment and can improve an organisation's image (Bansal and Clelland, 2004). In a similar vein, total quality management (TQM) is known as the other valuable GSCP measurement. Total quality management (TQM) is an effective process for achieving zero defects, reducing waste and developing training (Sroufe and Curkovic, 2008). Initiated to import a series of concepts, tools and techniques, TQM improves firm processes and competitiveness (Lo et al., 2013). Another important GSCP measurement is green purchasing (GP) which refers to environmentally preferable purchasing (Yook, Choi and Suresh, 2017). This dimension mainly relies on environmental activities such as cooperation with suppliers, supplier evaluation and supplier environmental certification (Rao and Holt, 2005; Vachon and Klassen, 2006).

As previously mentioned, many studies have been conducted on GSCP dimensions. However, as these studies have not investigated these dimensions in detail, a gap is apparent in the GSCP domain. Hence, this study attempts to investigate these three significant environmental practices in detail. Green supply chain practices (GSCPs) have seldom been measured in empirical research as a multidimensional model.

Therefore, this research sought to fill this gap by applying a multidimensional framework and analysing the above-mentioned dimensions using SmartPLS software.

1.2.4 Performance

Applying various GSCPs can provide valuable opportunities for firms to improve their performance (Green et al., 2012; Jabbour et al., 2015). Different scholars have sought to measure the profitability of GSCM based on the dissimilar aspects of environmental (Yang et al., 2013; Zhu, Sarkis and Lai, 2013); economic (Diabat, Khodaverdi and Olfat, 2013; Zailani et al., 2012); operational (Lee, Kim and Choi, 2012; Zailani et al., 2012); and intangible (Laosirihongthong, Adebanjo and Tan, 2013). Environmental performance mainly refers to the minimisation of waste and reduction of energy consumption owing to cost minimisation and the development of economic performance (Rao and Holt, 2005). Operational performance is related to the strategic preferences and competitive priorities in which companies choose to compete (Narasimhan and Das, 1999) and is mainly based on quality, and flexibility (Pagell and Krause, 2002). Consequently, improvements in environmental performance and operational performance, in terms of waste reduction, resources' conservation and operational factors, can develop a firm's economic performance (Zhu, Sarkis and Lai, 2013). In the current study, the attempt is made to investigate three dimensions: (1) environmental as green supply chain practices are mainly related to environmental performance; (2) economic as financial issues are a crucial factor for any organisation; and (3) operational factors as research about the operational dimension is still rare (Zhu, Sarkis and Lai, 2013). Due to time limitations, the current study has not considered intangible performance.

The above discussion indicates that several studies have analysed different aspects of firm performance (Wu, Ding and Chen, 2012; Lin and Ho, 2011; Lo and Shiah, 2016). However, empirical studies on GSCPs and firm performance have rarely used a multidimensional model. Hence, the current study attempts to fill this gap by investigating the relationships between external determinants and GSCPs through a multidimensional model. Although many studies have dealt with GSCPs and firm performance, the paucity of theoretically supported and empirically validated models

for the combined effect of external determinants and internal determinants on GSCPs and firm performance has been observed. Hence, this research attempted to address this gap through investigating the relationships between external and internal supply determinants on GSCPs and firm performance.

1.2.5 Food industry

Food supply chains play a significant role in the global economy (Ghosh, 2010). As foods are produced and consumed all around the world, the associated processes are closely associated with a variety of important issues such as the consumption of natural resources, employment and emissions (Ala-Harja and Helo, 2014). The specific context of food production and consumption is characterised by features such as high-volume consumption, short shelf-life, perishability, sensitivity to cost and security issues (Opara, 2003; Cohen and Garrett, 2010). In today's competitive market, excessive attention is directed towards these specific products and their processes, and they are constantly under the scrutiny of the public, and government and non-government bodies (Beske, Land and Seuring, 2014). It is therefore crucial for firms involved in the food industry to pay more attention to new policies and technological developments and to understand how to appropriately deal with and adopt them. For example, one important strategic issue for all industries and particularly for this specific industry is taking into consideration environmental issues in terms of green practices. These can bring firms more environmental and economic benefits, such as energy savings and cost reduction (Rao and Holt, 2005). The current study has concentrated on the Australian food industry as the largest manufacturing sector in Australia is food and beverages. This industry makes a significant contribution to the Australian economy, with a total turnover of A$127 billion and employing approximately 320,302 people. This represents a significant proportion of employment in comparison to other industry sectors, such as the mining industry, utilities, information media and telecommunications (AFGC, 2017). However, there is a paucity of application in food industry.

1.3 RESEARCH QUESTIONS

Limitations in areas such as GSC antecedents, GSCPs and GSC performance have been noted in previous studies. Thus, this study attempted to increase the GSCP understanding and knowledge base. More specifically, this study aimed to develop a multidimensional framework. Relying on institutional theory (IT) and the resource-based view (RBV), and the existing literature on GSCM, it is evident that GSCM is essential in developing firm competitiveness.

This study seeks to identify and measure the relationships and effects of external determinants and internal supply determinants on GSCPs and how these relationships can influence the ultimate firm performance. It is important to note that this study analysed the direct role of external determinants on GSCPS as well as the indirect role of external determinants on GSCPs through internal supply determinants. Based on the theoretical foundation mentioned in previous sections, the focus of this study is to investigate the following research questions through a wider study:

- How do external determinants impact on green supply chain practices in the Australian food industry?
- How do internal supply determinants impact on green supply chain practices in the Australian food industry?
- How do external determinants impact on internal supply determinants in the Australian food industry?
- How do external determinants impact on green supply chain practices through internal supply determinants in the Australian food industry?
- How do green supply chain practices impact on firm performance in the Australian food industry?

By answering these important questions, this study attempts to address the gap in the extant literature.

1.4 RESEARCH OBJECTIVES

Based on the research questions above, the objectives of this study are as follows:

* To investigate the role of external determinants in improving green supply chain practices in the Australian food industry

* To identify the role of internal supply determinants in improving green supply chain practices within the Australian food industry.

* To investigate the role of external determinants on internal supply determinants within the Australian food industry.

* To investigate the influential role of external determinants on green supply chain practices through the mediatory role of internal supply determinants in the Australian food industry?

* To investigate the role of green supply chain practices in improving firm performance within the Australian food industry.

1.5 DEFINITION OF TERMS

The following statements present the functional definitions of the terms used throughout this study:

Green supply chain management (GSCM): This is defined as "a buying organization's plans and activities that integrate environmental issues into supply chain management in order to improve the environmental performance of suppliers and customers" (Lee and Klassen, 2008, p. 575).

Agility: This is defined as the "capability of the firm to respond in a speedy manner to marketplace changes both internally and in conjunction with its key suppliers and customers" (Braunscheidel and Suresh, 2009).

Environmental management system (EMS): As stated by Nickerson and Viana (2002, p.5) environment management system is 'that part of the overall management system which includes organizational structure, planning activities, responsibilities, practices, procedures, process, and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy".

Green purchasing: Min and Galle (2001, p. 1223) defined green purchasing as "an environmentally-conscious purchasing practice that reduces sources of waste and promotes recycling and reclamation of purchased materials without adversely affecting performance requirements of such materials".

Total quality management (TQM): According to Crosby (1986), quality is "conformance to requirements or specifications".

1.6 SIGNIFICANCE OF THE RESEARCH

This study offers both theoretical and practical contributions. In seeking to investigate the relationships between external determinants and internal supply determinants of GSCPs and the impact on firm performance in the Australian food industry, the researcher has proposed and developed a comprehensive research model based on the broad literature review and two significant GSCM theories: institutional theory (IT) and the resource-based view (RBV); thus, this research model is both significant and unique. As found in the previous literature, many studies have been conducted on external determinants (EXDETs), internal supply determinants (INTDs), GSCPs and firm performance. Referring to DiMaggio and Powell (1983), the important role of EXDETs in terms of government support and buyer cooperation is justified through the lens of institutional theory which emphasises how firms address green practices with their existing external determinants (EXDETs) (Zhu, Sarkis and Lai, 2013; Rasi, Abdekhodaee and Nagarajah, 2014; Nezakati, Fereidouni and Rahman, 2016; Adebanjo, Ahmed and Teh, 2016). Moreover, firms can develop their capabilities through their resources, including intangible resources such as agility and their INTDs, with the importance of these resources justified through the lens of resource-based view (RBV) theory (Barney, 1991). This theory emphasises that intangible resources are a source of power for firms. Therefore, the current research has strong theoretical support through the lens of institutional theory (IT) and RBV theory to justify its conceptual framework.

1.7 STRUCTURE OF THE THESIS

This thesis is organised and presented in seven chapters as illustrated in Figure 1.1. The summary of each chapter is described below the figure.

Structure	Description	Output
Chapter 1	**Introduction (of the thesis)** Develops the research problem	Determines the research questions and objectives
Chapter 2	**Literature Review and Conceptual Model** Discovers the existing research gap Develops the research model	Reviews the relevant literature and develops the research model
Chapter 3	**Research Methodology and Design** Explains the research methodology	Presents the quantitative approach for conducting this research
Chapter 4	**Development of Hypotheses and Measurement Instrument** Provides details of the hypotheses and questionnaire	Formulates the hypotheses and designs the questionnaire
Chapter 5	**Administration and Analysis of Survey** Explains the details of the survey Data analyses by deploying partial least squares (PLS)	Presents the survey analysis data
Chapter 6	**Discussions and Implications** Discusses the research findings	Interprets the research findings
Chapter 7	**Conclusions, Limitations and Future Research** Provides an overview of the research	Summarises the research and the thesis

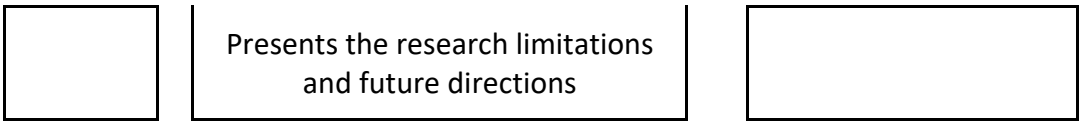

Figure 1.1: Structure of the thesis

Chapter 1 Introduction

Chapter 1 provides an outline of the current study comprising: the importance of the research; establishment of the study's context regarding the GSC determinants, GSCPs and firm performance; and finally, presentation of the existing gap in the previous literature. This is then followed by formulation of the research questions and research objectives. Finally, the chapter states the potential contributions of the study.

Chapter 2 Literature Review and Conceptual Model

Chapter 2 presents the broad literature review focusing on definitions, applications and importance of external determinants, internal supply determinants, GSCPs and firm performance. This chapter also proposes the justification for selecting the Australian food industry as the case subject, followed by presenting statistical information. Finally, the research model is developed based on the extensive literature review.

Chapter 3 Research Methodology and Design

In Chapter 3, the study's methodological basis is explained. The chapter basically emphasises the justification of the research approach and the appropriateness of the applied methodology. This chapter also details the sample selection and data collection processes.

Chapter 4 Development of Hypotheses and Measurement Instrument

Chapter 4 presents the development of the research hypotheses based on the comprehensive research model in Chapter 2. The details of the questionnaire used for the research survey are also described in Chapter 4.

Chapter 5 Administration and Analysis of Survey

Chapter 5 describes the quantitative data analysis conducted through using the PLS-based structural equation modelling (SEM) technique. It then presents the hypothesised relationships between the constructs in the research model.

Chapter 6 Discussions and Implications

Chapter 6 discusses the findings of the PLS data analysis as they correspond to the research objectives. This chapter also describes the theoretical and practical implications of the research results.

Chapter 7 Conclusions, Limitations and Future Research

Chapter 7 summarises the research findings and presents the study's significant contributions to theory and practice. This chapter also presents several limitations of the study and briefly discusses possible directions for future research.

1.8 CHAPTER SUMMARY

This chapter provided an introductory overview of the current research and outlined how the identified gap has been addressed. It discussed the existing research on GSCPs' external and internal factors, GSCPs and firm performance. This chapter then defined the research questions and objectives and, finally, it presented an overview of the organization of this research thesis.

CHAPTER 2

LITERATURE REVIEW AND CONCEPTUAL MODEL

2.1 INTRODUCTION

This chapter presents the major theoretical views of green supply chain management (GSCM). As identified in Chapter 1, comprehensive studies that investigate the relationships between GSC antecedents, including external determinants and internal supply determinants, and GSCPs and, in turn, firm performance are rare. Although many studies have investigated the relationships between organisational (internal) determinants and GSCPs, studies on relationships between internal supply determinants and GSCPs are scarce. To be specific, the mediation role of internal supply determinants in the development of GSCPs through external determinants has not been considered.

Reviews and summaries of the previous literature can improve our understanding of GSC antecedents, GSCPs and firm performance. This chapter consists of nine main parts following this introduction. Section 2.2 describes the Australian food industry as well as the rationale for considering this specific industry as the study population. Section 2.3 illustrates the supply chain, its definition and its different approaches. Section 2.4 deliberates on the development of GSCM including GSCM and sustainability. Section 2.5 explains the important antecedents of GSCPs, including external determinants (government, buyers and suppliers) and describes internal supply determinants (internal supply relationships and agility). The GSCP measurements including total quality management (TQM), environmental management systems (EMSs) and green purchasing (GP) are detailed in Section 2.6. In Section 2.7, three kinds of green performance, namely economic, environmental and operational are presented in detail followed by a presentation of the research gaps in Section 2.8. The theoretical justification is described in Section 2.9. Finally, in Section 2.10, a comprehensive research model based on the previously mentioned extensive literature review is developed and described.

2.2 FOOD INDUSTRY OF AUSTRALIA

The Australian food and agribusiness sector is divided into two subsectors: food products and agribusiness products. The food products subsector is related to all food processing and beverage manufacturing while the agribusiness products sector includes all agricultural products, such as fresh produce, and grocery items linked to food production (DIIS, 2018). The contribution of Australia's food and agribusiness sector is significant to Australia's economic situation through two important factors: employment and business opportunities (Rural Bank, 2016/17).

In relation to employment, approximately 320,302 people work in this specific industry which represents a significant portion of employment in comparison to other industries, such as the mining industry, telecommunications industry, utilities and information media (AFGC, 2017). In terms of business opportunities, the Australian food and agribusiness sector is an economic propeller of the country due to the size of its turnover at over A$127bn with an industry value-add (IVA) of A$33.6bn of gross domestic product (GDP) in 2016–17 (AFGC, 2017). The top five products/production processes in the Australian food industry, based on turnover, are meat product manufacturing; dairy products; other food product manufacturing; sugar and confectionery manufacturing; and bakery product manufacturing (AFGC, 2017).

The Australian food industry is extremely dependent on food exports as over half of Australia's agricultural products are exported to other countries at a value of approximately A$49.9bn (Rural Bank, 2016/17). On the other hand, the value of Australian food imports was approximately A$35.3bn (AFGC, 2017, p. 25). The Australian food industry's main trading partners, in terms of imports and exports, are the United States (USA) and China. It should be noted that other countries, such as India, Malaysia and the Netherlands, are developing their trade activities (AFGC, 2017).

In terms of innovation, Australia has a proud history of innovation and adaptation (PWC, 2017). Investment is growing to develop Australian industries: in this specific context (the food industry), capital investment of approximately A$2.9bn (AFGC, 2017) has been made. The reason is that the food industry is regarded as a dynamic industry that is buyer-dominated requiring the ability to quickly respond to buyer demands (Trienekens et al., 2012). Buyers today are increasingly concerned about the products they consume, including the product's origin, and the labour standards, animal welfare and environmental impact of production in that place of origin (Trienekens et al., 2012). Simply stated, attention is increasingly being directed towards sustainability in terms of economic, environmental and social issues (Chin, Tat and Sulaiman, 2015; Paulraj, 2011; Schaltegger and Burritt, 2014) with more research required in this area.

The Australian food industry is seeking to pay more attention to the philosophy of sustainability which has even had an effective impact on not only its domestic market but also on its international market (A.G.C, 2015). In both domestic and international markets, the Australian food industry has a high reputation with its high-quality products produced in a safe clean environment (A.G.C, 2015). However, it is essential that more continuing attention is directed towards the issue of sustainability to maintain competitiveness in all markets. The current study concentrated on environmental sustainability, known as "green" by the Australian food industry. This study attempted to understand the relationships between influential external and internal supply determinants and the development of GSCPs and, in turn, firm performance. It is noted that a study along these lines has not been conducted in the context of the Australian food industry.

The substantial work in the literature on the GSCM domain includes research on external determinants, internal determinant, GSCPs and firm performance. However, firstly, few studies have thoroughly investigated the relationships between external and internal supply chain determinants and their impact on GSCM and firm performance. Secondly, the current study found no prior research on understanding the indirect impact of external determinants on GSCPs through internal supply

determinants. Therefore, the current study sought to fill this gap. In this study, through its development of a multidimensional model, not only is the direct impact of external determinants on GSCPs analysed, but the indirect impact of external determinants on GSCPs through the mediation role of internal supply determinants is also examined. In addition, studies on the food industry GSC are still rare. Hence, the current research concentrated on the specific context of the food industry.

2.3 SUPPLY CHAIN

According to Cooper, Lambert and Pagh (1997, p. 2), the supply chain (SC) is a complex operational concept which is related to integration among suppliers, manufacturers and distributors to meet consumer demands in an efficient and effective manner. In this definition, supply chain management (SCM) covers all activities from providing raw materials to final product delivery (Beamon, 1999). Organisations have realised that the performance of each entity in the supply chain is not enough on its own to achieve the supply chain's overall performance success (Copper, Lambert and Pagh, 1997). This means that integration across the chain is essential if success is to be achieved.

Organisations cannot act in isolation, with much depending on the capabilities and resources embedded in their suppliers, customers and collaborators (Giannakis and Croom, 2004; Hakansson and Snehota 1995). Attention began to be directed towards SCM in 1980 when organisations realised the benefits of collaborative relationships via SCM within their boundaries (Lummus and Vokurka, 1999; Croom, Romano, and Giannakis, 2000).

Basically, the concept of SCM was formed based on two separate research streams, namely, the traditional purchasing approach (Morgan and Monczka, 1996; Lamming and Hampson, 1996; Kraljic, 1983) and the logistics functions approach (Fisher, 1997; Lam, 1995). In the traditional purchasing approach, SCM attempts to establish a close relationship and integration with suppliers to achieve more efficiency and effectiveness in managing the purchasing and supply function. This approach includes benefits such as reducing inventory and cycle time and increasing customer

satisfaction, market share and profits for the organisation. However, this approach focuses more on the manufacturing side with not much attention directed towards the wholesale or retail industry.

On the other hand, wholesalers and retailers endeavour through the transportation and logistics functions approach to achieve integration of the logistics functions and partnership with their transportation providers to improve efficiency and effectively manage transportation and distribution. This approach attempts to decrease inventory level by establishing accurate information; reducing demand uncertainty; and reducing transportation cost. This SCM perspective focuses much attention on the wholesalers' and retailers' sides and directs little attention towards supplier partnerships (Tan et al*.,* 1999; Harwick, 1997 and Watts, Kim and Hahn, 1995*).*

Integrating these two approaches, that is, purchasing and logistics could create a closely linked set of manufacturing and distribution processes. This would create a better situation for organisations in delivering products and services to both internal and external customers in an effective manner and on time (Tan et al., 1999). Overall, two important reasons for the emergence of SCM are: firstly, organisations understand that optimisation of their performance depends on managing the entirety of the integrated components in the supply chain. Secondly, making decisions for each supply chain activity is based on analysing the effect of each decision on the entire supply chain as the integrated components influence each other (Lam, 1995 and Carter and Ferrin, 1995).

The strong demand from globalisation is for SCM to reach beyond purely economic issues to matters such as fair labour conditions and environmentally friendly production in terms of sustainable development which is usually comprehended in economic, environmental and social dimensions. Managing supply chains in a sustainable manner has become an increasing concern for organisations of all sizes and across a wide range of industries. This more reactive approach of responding to external pressures from governments, consumers, non-governmental organisations (NGOs) and the media can be complemented by the development and introduction

of sustainable products (Seuring and Gold 2013). Figure 2.1 shows the GSCM paradigm.

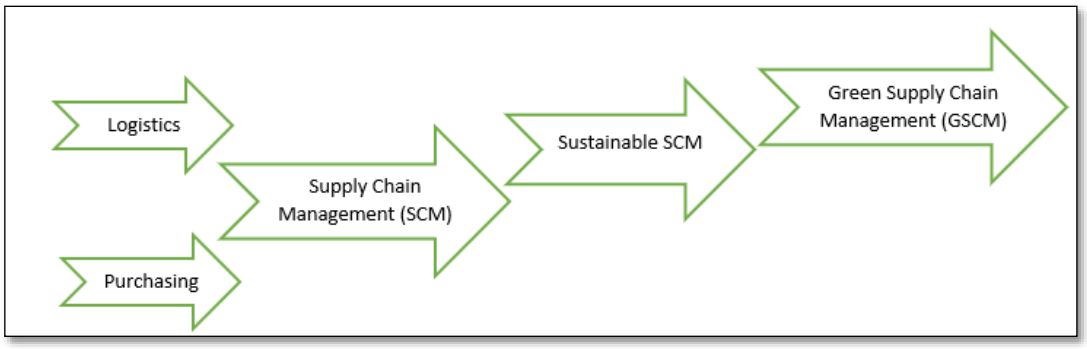

Figure 2.1: Green supply chain management (GSCM) paradigm

2.4 DEVELOPMENT OF GREEN SUPPLY CHAIN MANAGEMENT (GSCM)

2.4.1 Sustainable supply chain management

The agenda of sustainability with regard to social and environmental performance has been brought into every walk of life by: climate change, reduction of resources, increased pollution, increased energy consumption and the violation of social rights (Carter and Easton, 2011; Chowdhury, 2014). Sustainability can be referred to as ‘‘creating long-term shareholder value by embracing opportunities and managing risks deriving from economic, environmental and social developments’’ (Jones, 2005, p. 7). In other words, it is intended to “make the world a better place for future generations” and to “provide the processes and products which will give the people of the world shelter, clothing, food and drink, and which keep them in good health” (Institution of Chemical Engineers [IChemE], 2005, p. 4). The most popular and the most often quoted definition of sustainability is “development that meets the needs of the present without compromising the ability of future generations to meet their needs” (WCED, 1987, p. 8). From the environmental perspective, sustainability means “the potential for reducing long-term risks associated with resource depletion, fluctuations in energy costs, product liabilities, and pollution and waste management” (Shrivastava, 1995, p. 955).

Awareness of the sustainability implications in SCM began in 1980 (Maloni and Brown, 2006). Sustainability is linked with SCM and is deeply incorporated into the fundamental parts of what the organisation needs to analyse the entire activities of it supply chain (Linton, Klassen, and Jayaraman, 2007). For example, it is important to discuss protection of the environment so people can have clean water, clean air and healthy foods. In this regard, social awareness is growing of the need for legislation to ensure environmental protection through managing organisations' sustainability. To demonstrate responsibility to stakeholders, the environmental issue needs to be acknowledged wherever it arises in the different stages of production, for example, the environmental performance of all supply chain members (Koplin, 2005). This enables organisations to generate competitive advantage and to cope with the increasing number of environmental regulations at various levels (regional, national and international) (Wu, Ding and Chen, 2012). Well-known companies face many pressures from their stakeholders, such as the government, buyers and NGOs, if they fail to meet sustainability requirements in their supply chain (Seuring and Muller, 2008). For example, companies such as Nike, Disney and Adidas have received criticism and accusations owing to their suppliers' inappropriate environmental activities in their production process (Chowdhury, 2014).

Overall, acceptance of an organisation's sustainability activities can boost its competitiveness as this can enhance the organisation's image in the eyes of customers and can increase its economic performance (Linton, Klassen and Jayaraman, 2007; Ageron, Gunasekaran and Spalanzani, 2012). For example, when the Ford Motor Company introduced an electrical vehicle with the aim of decreasing CO_2 emissions, this vehicle was sold in many countries and possibly could save this company from an economic slump and improve its business (Ford, 2018). In Australia, The Environment Protection and Biodiversity Conservation Act 1999 is the Australian Government's central piece of environmental legislation and is responsible for developing environmental regulation (AGDEE, 2018). Legislation implemented under this department's supervision and intended to protect and manage national and international ecological and heritage communities.

In 2005, the United Nations Commission on Sustainable Development (UNCSD) introduced the three pillars of sustainability: environmental sustainability, social sustainability and economic sustainability (Delai and Takahashi, 2011). In the SCM research stream, sustainability is mainly discussed in terms of GSCM with this being the focus of the current research. Significant issues with a focus on GSCM have been published in several journals such as: the *Journal of Supply Chain Management* (Pagell and Wu, 2009); *Journal of Cleaner Production* (Seuring and Muller, 2008); *Corporate Social Responsibility and Environmental Management* (Gold, Seuring and Beske, 2010); and the *International Journal of Physical Distribution and Logistics Management* (Carter and Easton, 2011). However, fundamental issues still require concentrated effort to help supply chain professionals to achieve environmental sustainability in supply chains (or GSCM) (Pagell and Wu, 2009; Chowdhury, 2014).

2.4.2 Green supply chain management (GSCM)

Green supply chain management (GSCM) is not a new concept. GSCM emerged as an important innovation helping organisations to develop 'win/win 'strategies that achieve profit while also lowering environmental risks (Zhu, Sarkis and Lai, 2007). Using GSCM and its focus on environmentally friendly practices as its basis, the organisation is obligated to rethink managerial behaviour towards practices such as environmental audits, achieving and sustaining environmental certifications, and collaboration with stakeholders (Vachon and Klassen, 2008). Simply stated, the GSCP philosophy is postulated as an innovative management practice that increases competitiveness due to the development of environmental performance (Wu et al., 2015).

Researchers have presented some definitions of GSCM over recent years. For example, Zhu, Sarkis and Geng (2005, p. 450) in their study on Chinese manufacturing stated that GSCM is "[a]n important new archetype for enterprises to achieve profit and market share objectives by lowering their environmental risks and impacts while raising their ecological efficiency". In a similar way, Buyukozkan and Cidci (2012) in their case study on Ford Motor Company defined GSCM as "a way for firms to achieve

profit and market share objectives by lowering environmental impacts and increasing ecological efficiency". These definitions imply that increasing ecological efficiency and preserving the environment bring more benefits and increase firm profits and market share.

In addition, Lee and Klassen (2008, p. 575), using a case study method in their study on the Korean automobile industry defined GSCM as "buying [an] organization's plans and activities that integrate environmental issues into supply chain management in order to improve the environmental performance of suppliers and customers". To improve GSCM, the latter two researchers posited the emergence of support for and monitoring of supply chain partners. In other words, they emphasised support-based GSCM through direct interaction between buyers and suppliers to improve suppliers' environmental performance. This approach describes an arm's-length relationship via monitoring and evaluating each supplier's activities. Similarly, Gavronski et al. (2011, p. 875) in their study on Canadian manufacturing stated that GSCM is "[t]he complex of mechanisms implemented at the corporate and plant level to assess or improve the environmental performance of a supplier base". This definition emphasises specific practices such as monitoring of and collaborating with suppliers through the buying organisation to ensure that suppliers behave in an appropriately environmentally friendly way. Based on the concept of GSCM in previous studies, this study embraces GSCM as:

> *The impact and interaction of multidisciplinary aspects including the external determinants and internal drivers to improve GSCM practices to achieve high performance*

This definition includes specific points. Firstly, it is about the significant impact of external determinants on GSCPs, with external determinants in this study being legislation, buyers and suppliers. Secondly, it is about paying more attention to internal factors, such as the impact of firm/supply chain agility, as well as establishing proper internal supply relationships to adopt along with ongoing environmental practices. Thirdly, it mentions the importance of understanding the interaction between external determinants and internal drivers that can facilitate the

improvement of GSCM practices. In other words, proper relationships between upstream (supplier) and downstream (buyer) supply chain firms, and government bodies, as well as collaboration and flexibility can improve green practices (i.e., TQM, green purchasing and EMSs) (Massoud et al., 2010; Govindan et al., 2010). Overall, this definition states that GSCPs can improve different aspects of firm performance as, for example, improving the environmental aspect requires operational performance to be improved and this may impact on economic performance.

The implementation of GSCM provides the firm/supply chain with additional benefits. The main benefits comprise: environmental (reduced emissions of greenhouse gases [GHGs]; economic (decreased amount of waste (Chiou et al., 2011; Zhu , Sarkis and Lai, 2007); achieving corporate profit and market share objectives (Zhu, Sarkis and Lai, 2008); improving product quality (Montabon, Sroufe and Narasimhan, 2000); and enhancing a firm's reputation and brand image (Laosirihongthong, Adebanjo and Tan, 2013; Kurien and Qureshi2, 2012) which can create an attractive situation for stakeholders (Chavez et al., 2016).

However, the implementation of GSCM principles faces various difficulties and barriers. According to Govindan et al. (2014), these difficulties can be categorised into significant groups and include: outsourcing (including difficulty in finding and maintaining partnerships with environmentally friendly suppliers (Hamner, 2006) need for training in the adoption of environmentally friendly practices (Massoud et al., 2010); lack of technical expertise and lack of appropriate technology for adopting GSCM (Perron, 2005); complexity of design for reuse or recycling of used products; lack of awareness about environmental legislation and GSCM benefits (Shen and Tam, 2002); high investment cost of GSCM and low returns from its implementation (Govindan et al., 2014); high cost of implementing the new system (Carter and Rogers, 2008); and lack of monitoring of progress and consultancy (Carter and Dresner, 2006) and top management resistance to change (Mudgal et al., 2010).

Green supply chain management (GSCM) achieves successful sustainable development through its valuable practices (Rao and Holt, 2005; Wu, Ding, and Chen,

2012). The main GSCM practices (GSCPs) based on the literature are: green purchasing (Lee, Kim and Choi, 2012; Lo and Shiah, 2016; Younis, Sundarakani and Vel, 2016; environmental management systems (EMSs); and total quality management (TQM) (Zhu, Sarkis and Lai, 2008, Sarkis et al., 2016 and Gunasekaran et al., 2008). Overall, the antecedents to the implementation of GSCPs arise from significant external and internal determinants that are described and investigated in this study.

2.5 GREEN SUPPLY CHAIN ANTECEDENTS

2.5.1 External determinants

The growing focus on environmental problems is by considering a variety of external determinants (Holt and Ghobadian, 2009; Chavez, Feng and Wiengarten, 2016; Mohanty and Prakash, 2014; Lo and Shiah, 2016). Therefore, it is essential to consider external drivers for the adoption of GSCPs, as well as their implementation. Organisations face more difficulties from the failure to meet environmental requirements from both the government and consumers through sanctions and the loss of market share (Zhao et al., 2017; Islam, Deegan and Gray, 2018). Although different scholars have suggested different dimensions, the current study, based on the previous literature and its discussions on institutional theory and stakeholder theory, has found that the most commonly supported external determinants that impact on developing GSCPs are: government (Zhu, Sarkis and Geng, 2005; Wu, Ding and Chen, 2012; Ali et al., 2017); suppliers' participation (Zhu, Sarkis, and Lai, 2007; Wu, Ding, and Chen, 2012); and buyers' cooperation (Vachon and Klassen, 2006; Wu, Ding, and Chen, 2012). In this study the construct external determinants exist in multidimensional domains as a higher-order construct. At the second-order level, external determinants are measured by the first-order formative constructs: government, supplier and buyers in reference to Gonzalez-Torre et al (2010). It is evident that most studies in the previous literature have used descriptive analysis of external determinants (e.g., Lo and Shiah, 2016; Mohanty and Prakash, 2014; Hu and Hsu, 2010; Thun and Muller, 2010). In the subsections below, the external determinants are described in detail.

2.5.1.1 Government

Government is known as a significant external factor that impacts on green supply chain practices (GSCPs) (Lin and Ho, 2011; Zhu, Sarkis and Lai, 2013; Lo and Shiah, 2016; Mohanty and Prakash, 2014). Government can play a supportive, as well as a coercive role, in the implementation of green practices (Nezakati, Fereidouni and Rahman, 2016). For example, government incentives can be a suitable motivator for organisations to become environmentally sustainable. Firms that show they are up to date with green practices can benefit from pricing strategies for their products and, by utilising green technologies, they can gain support from funding programs. Organisations that are well informed about environmental legislation therefore do not face as much threat from their competitors (Formentini and Taticchi, 2016). In addition, government can play a significant role in the integration of circumstances between supply chain partners (Sheu, 2015). This means that government can play coordinating and integrating roles between all supply chain participants by facilitating information sharing and monitoring practitioners in the green supply chain (Nezakati, Fereidouni and Rahman, 2016). Although government has a supportive role, those organisations that do not respect environmental issues can regard government as a threat as it can, for example, impose taxes (Clemens and Douglas, 2006) and destroy organisations' reputations (Chen, Chang and Lee, 2015; Nezakati, Fereidouni and Rahman, 2016).

Many countries have established environmental regulations as their response to international environmental protection measures. For example, Taiwan's government has enacted a green purchasing regulation, while the German government has announced a packaging waste law (Walker, Di Sisto, and McBain, 2008). Furthermore, Australia has a national statutory framework for regulating product safety and information standards, with these standards designed to ensure that harmful products are not marketed in Australia (ATIC, 2018). In addition, under Australia's federal system of government, responsibility for environmental regulation is carried concurrently by the Australian government and state/territory governments.

The role of government as a significant external factor that impacts on GSCPs has been identified and emphasised in different contexts in many studies (Delmas and Toffel, 2004; Zhu, Sarkis and Geng, 2005; Lee, 2008; Lin and Ho, 2011). For example, Delmas and Toffel (2004) in their study of US manufacturing stated that government is an important external factor in GSCP development. The authors emphasised the authority role of government through which it can force organisations to comply with environmental regulations (Delmas and Toffel, 2004).

In addition, Walker, Di Sisto, and McBain (2008) identified the main external factors that drive or hinder the adoption of GSCPs among manufacturing firms in the United Kingdom (UK). Their findings revealed that government is not only a major external driver but also a major barrier to the implementation of green practices. The authors stated that government could minimise the risk of environmental efforts for those organisations that comply with environmental regulations. Conversely, regulations could prevent innovation by proposing best available techniques and setting strict deadlines by which environmentally friendly practices must be employed (Walker, Di Sisto, and McBain, 2008). Lee's (2008) study on the role and influence of external determinants on GSCPs among Chinese manufacturing companies however stated that the government did not directly impact on these practices. In that study, Lee (2008) emphasised that the government's indirect role included technical and financial support and cutting taxes for companies that developed environmentally friendly structures in their GSCP development. In a similar vein, the research undertaken by Lin and Ho (2011) investigated the impact of external determinants on GSCPs among Chinese logistics organisations. In that research, Lin and Ho (2011) found that government pressure significantly influenced the adoption of GSCPs through financial and technical support. The study of Wu, Ding and Chen (2012) on Taiwan's textile and apparel industry also considered the role of government as a GSCP driver. Based on the previous literature, it therefore appears that government is an essential external factor that enables an organisation and its supply chain to develop green supply chain practices (GSCPs).

2.5.1.2 Buyers/customers

Among the institutional pressures faced by organisations, customers are one of the major pressures for implementing environmentally friendly practices (Mohanty and Prakash, 2014; Lee, 2008; Lo and Shiah, 2016). Customer requirements are known to be an influential market weapon to control and encourage supply chain partners (suppliers) to participate in environmentally friendly practices and to improve firm environmental performance (Lee and Klassen, 2008). For example, customers were found to be the second most cited source of pressure for implementing environmentally friendly practices among Canadian firms (Henriques and Sadorsky, 1996). Buyers are an essential factor for pushing ecological pressure along the supply chain to suppliers, forcing them to pay more attention to environmentally friendly practices and environmental regulations (Caniels, Gehrsitz and Semeijn, 2013). For instance, Chinese customers play a significant role in forcing organisations to be EMS-certified (Christmann and Taylor, 2001). Therefore, any changes in buyers' environmentally friendly procurement policies and practices can directly impact on suppliers' behaviour (Lee, 2008). At the same time, these efforts can increase costs (Min and Galle, 2001).

It is important to note that each firm can be both a buyer to its suppliers and a supplier to its customers; therefore, environmental collaboration and monitoring are important factors both upstream and downstream in the supply chain (Vachon and Klassen, 2008) when seeking to control and improve environmental performance (Green et al., 2012). In addition, more collaboration with customers results in less business waste, reduced environmental costs, increased customer satisfaction and improved volume of returns (Azevedo, Carvalho and Machado, 2011), all of which can increase the firm's environmental, operational and economic performance (Zhu, Sarkis and Lai, 2013). The reason is that customers' environmental cooperation assists the organisation to identify customers' needs which enables suppliers to respond quickly to appropriately meet those needs (Laari et al., 2016). Moreover, buyers can improve suppliers' environmental performance through procurement activities, such as establishing supplier assessment criteria, as well as by evaluating

their environmental performance, supporting activities, training programs, sharing information and undertaking collaborative research and development (Vachon and Klassen, 2006).

The role of buyers as a significant external driver for GSCM improvement has been explained in a considerable body of research (Lee, 2008; Zhu, Sarkis and Lai, 2008; Thun and Muller, 2010). For example, the study undertaken by Lee (2008) investigated the impact of external determinants on GSCPs within South Korean manufacturing firms. In that study, Lee (2008) emphasised the significant impact of buyers through their willingness to have a green supply chain and their provision of technical assistance to improve GSCPs (Lee, 2008). Also, in that year, Zhu, Sarkis and Lai (2008) conducted a study that sought to understand the role and influence of external determinants on GSCPs in Chinese manufacturing firms. Their study explored the impact of buyers as a significant external factor in relation to green supply chain practices (GSCPs). Zhu, Sarkis and Lai (2008) found that cooperation with buyers was a strong external factor which could improve green practices.

In a similar vein, Thun and Muller (2010) conducted a study that investigated the impact of external factors on GSCP development in German manufacturing firms. In their study, Thun and Muller (2010) emphasised the role of customer participation in environmentally friendly practices, such as the reduction in waste and packaging, when undertaking GSCP development. Their findings demonstrated that customers were the main drivers for improving green supply chain practices (GSCPs). Moreover, Lo and Shiah (2016) focused in their study on the influence of buyer expectations as a significant external factor in developing GSCPs among Taiwanese electronic manufacturing firms. Therefore, based on the prior research, it appears that buyers are a prominent external factor that encourages organisations and their supply chain to improve green supply chain practices (GSCPs).

2.5.1.3 Suppliers

A critical GSCM component relates to finding appropriate suppliers that are willing to contribute to GSCPs (Mohanty and Prakash, 2014; Zhu, Sarkis and Lai, 2013; Lee,

2008; Lo and Shiah, 2016). Organisations have realised that cooperating with business partners can help them to achieve successful GSCP implementation, but this is not an easy task. Suppliers need to implement wide-ranging environmentally friendly programs to control and develop their environmental activities, such as environmentally friendly packaging and sharing environmental management techniques and knowledge (Vachon and Klassen, 2008 and Rao, 2002). These factors can be appropriately implemented through selecting suppliers deemed suitable due to their advances in green practices (Min and Galle, 2001; Vachon and Klassen, 2006, Paulraj, 2009); assisting suppliers to improve environmental practices (Vachon and Klassen, 2006); controlling suppliers' operations (Vachon and Klassen, 2009); visiting supplier sites to provide technical assistance (Vachon and Klassen, 2006); and developing environmental management systems (EMSs) through both technological innovation and better resource management (Geffen and Rothenberg, 2000).

Good examples are available on the importance and necessity of participation with appropriate suppliers. For example, in US manufacturing, it is vital for firms to evaluate their suppliers' capabilities due to regulations in areas such as distribution, safety and health and the need for compliance with the federal Environmental Protection Agency (EPA) and the Resource Conservation and Recovery Act. Another good example is the Dow Chemical Company which only works with suppliers that are part of the voluntary Responsible Care initiative for safe disposal (Handfield et al., 2002).

Overall, suppliers are able to have an effective role in the market environment through their green activities. In regard to suppliers' green role in developing green initiatives, the current study attempts to focus on this factor in the Australian food industry.

Although suppliers are known as effective external factors in the development of GSCPs, only a few studies have investigated their role (Roehrich, Hoejmose and Overland, 2017; Rao and Holt, 2005; Vachon and Klassen, 2006 and Hu and Hsu, 2010). For example, Rao and Holt (2005) developed a conceptual model and investigated the role of supplier involvement in GSCPs in South East Asian organisations. These authors emphasised the crucial role of suppliers in green

practices such as green purchasing to reduce waste and materials substitution through the environmental sourcing of raw materials. In that study's findings, Rao and Holt (2005) indicated that the organisation should hold training seminars for its suppliers; ask suppliers to achieve environmental standards; and meet with suppliers to solve problems. In addition, these authors stated that the organisation should select suppliers based on their environmental practices (Rao and Holt, 2005).

In the study by Vachon and Klassen (2006), the relationship between supplier characteristics and green practices in the US printing industry was investigated. In that study, supplier characteristics related to their size, investment rate and GSCPs were investigated in relation to environmental collaboration and environmental monitoring. The results showed the strong linkage between suppliers' features and GSCP improvement. Similarly, Lee (2008) conducted a study to better understand the role of suppliers in the implementation of GSCM practices in South Korean manufacturing. The result revealed the crucial role of suppliers in GSCP implementation. Lee (2008) emphasised the importance of suppliers' capabilities, such as cross-functional communication, managers' environmental awareness and their financial, human and technical resources, in GSCP implementation.

In a similar vein, Hu and Hsu (2010) attempted to learn more about the role of suppliers in improving GSCPs in Taiwanese electronics companies. The result demonstrated that a crucial role in improving GSCPs was played by the firm managing its suppliers, for example, environmental auditing; meetings with suppliers; collaboration with suppliers; and requests for suppliers' environmental requirements. These findings were in line with the earlier literature (Rao, 2005). Similarly, in the study by Roehrich, Hoejmose and Overland (2017) the role of green supplier to develop GSCM and firm performance were investigated. In this qualitative research approach, the result shows that motivating supply chain partners effectively can develop GSCP and firm performances. Therefore, based on the above-mentioned literature, in developing GSCPs, suppliers are essential external factors.

Overall, this section has reviewed the literature on external determinants for green supply chain practices (GSCPs). Table 2.1 presents the external determinants that influence GSCP adoption. Through reviewing the above-mentioned studies, it appears that empirically validated and integrated measurement using a multidimensional external determinant model is still rare. Further investigation therefore needs to be undertaken to develop a valid multidimensional measurement of external factors that are effective on GSCP adoption. Hence, the current study has attempted to fill this gap through applying a multidimensional approach to the investigation of external determinants.

Table 2.1: External determinants influencing GSCP adoption

Dimension	Study method/s	References
Considers customer pressure, regulatory pressure, governmental support and environmental uncertainty as the components of external determinants.	Regression	Lin and Ho (2011)
Buyer, government and suppliers are the antecedents of GSCPs	Regression	Lee (2008)
Considers shareholders, competitors, industry associations, government and consumers as significant influential external determinants on GSCP development	Presented a framework	Delmas and Toffel (2004)
Considers government, market pressures and competitiveness as external factors to develop GSCPs	Regression	Wu, Ding and Chen (2012)
External determinants including government, customers and suppliers are antecedents of GSCPs	Descriptive statistics	Zhu, Sarkis and Geng (2005)
Introduces regulation, customers and competitors as the components of GSCPs	Matrices analysis	Walker, Di Sisto, and McBain (2008)
Considers supplier involvement in GSCP development	Qualitative research	Roehrich, Hoejmose and Overland (2017)
Suppliers and customers are antecedents of GSCP	Regression	Vachon and Klassen (2006)
Considers role of suppliers in improving GSCPs	SPSS	Hu and Hsu (2010)
Considers government, customers, suppliers and competitors as external factors	Empirical research	Thun and Muller (2010)

Considers regulation, as well as customers' and suppliers' expectations as external determinants that drive GSCP development	Regression	Lo and Shiah (2016)

2.5.2 Internal supply determinants

While external determinants are important factors in developing GSCPs, based on the resource-based view (RBV), intangible resources can also improve these practices (Hoejmose, Brammer and Millington, 2012; Sharfman, Shaft and Anex, 2009; Hassan et al., 2016). In fact, the previous literature's main emphasis has been on the role of internal organisational factors such as supporting cross-functional teams, employees and management in GSCP development (Zhu and Sarkis, 2004; Zhu, Sarkis and Lai, 2007; Mohanty and Prakash, 2014; Lo and Shiah, 2016). However, research on the impact of internal supply determinants is still rare (Hoejmose, Brammer and Millington, 2012). Research has found that the important dimensions of internal supply determinants are internal supply relationships (Hassan et al., 2016; Sharfman, Shaft and Anex, 2009; Hoejmose, Brammer and Millington, 2012) and agility (Mirghafoori, Andalib and Keshavarz, 2017; Jain and Gupta, 2016). These two dimensions are closely linked as the development of relational norms can create an arms-length relationship in the supply chain which is related to the agility needed to meet environmental requirements. In the current study, internal supply determinants exist in multidimensional domains as a higher-order construct. At the second-order level, internal supply determinants are measured by the first-order constructs: agility and internal supply relationships. In the subsections below, these internal supply determinants are explained in detail.

2.5.2.1 Agility

One fundamental supply chain feature is agility which is known as a competitive weapon for a business's survival in today's turbulent markets with corresponding developments occurring in the supply chain (Agarwal, Shankar, and Tiwari, 2007; Narasimhan and Das, 1999). The business environment today constantly faces numerous and unpredictable changes: if the organisation cannot keep up with the speed of these changes, it faces severe failures and misses opportunities (Agarwal, Shankar, and Tiwari, 2007). This process requires organisations to

demonstrate spontaneity in their understanding of how to respond appropriately to the changed environment (Goldman, Nagel, and Preiss, 1995). Hence, agility is introduced as a winning approach for the firm/supply chain in responding rapidly to change (Goldman, Nagel, and Preiss, 1995; Christopher and Towill, 2001; Carvalho et al., 2016).

Since 1991, when the term "agility" was coined in this context by the Iaccoca Institute of Lehigh University in the USA, many researchers have taken an interest in agility concepts and agility capability. For example, Sharp, Irani and Desai (1999) in their study on UK manufacturing firms stated that agility is the supply chain's ability to respond quickly to changes in the market. This definition indicates that the nature of a dynamic business environment makes a business/supply chain more competitive as it needs to quickly respond to oncoming changes. Another definition was provided by Samamurthy, Bharadwaj and Grover (2003) who stated that agility is "the ability to detect opportunities for innovation and seize those competitive market". This definition mainly concentrates on innovation which enables the organisation/supply chain to survive in the market.

A comprehensive idea of agility can be obtained from the definition of Braunscheidel and Suresh (2009, p. 119) who, in their extensive literature study, stated that agility is the "capability of the firm to respond in a speedy manner to marketplace changes both internally and in conjunction with its key suppliers and customers". Each part of this definition contains an important concept that describes the uniqueness of agility. Firstly, this definition strongly emphasises that agility is important when sudden and unanticipated disruptions occur in the supply chain. Secondly, agility requires supply chain cooperation and collaboration to improve the use of resources and to maximise information accessibility (Ryu, Tsukishima, and Onari, 2009). Based on the concept of agility in previous studies, this study embraces agility as:

> *[the] ability to respond to the market's environmental demands via assisting internal supply factors as well as responding to pressures from external factors to improve its environmental practices and performance.*

The agile supply chain needs several capabilities to respond appropriately to dynamic environments (Christopher, 2000). The term “capabilities” addresses the role of management in responding to environmental factors by incorporating and reconfiguring resources and organisational skills (Teece, Pisano, and Shuen, 1997). Numerous capabilities have been introduced to establish agility in the firm/supply chain (Goldman, Nagel and Preis, 1995; Christopher, 2000; Lin, Chiu and Chu, 2006). The most common capability in the literature that can assist the green supply chain to become more efficient comprises the following three significant dimensions:

- Flexibility: This dimension focuses on the ability to implement various processes and apply different facilities to reach the goal (Zhang and Sharifi, 2000; Sharp, Irani and Desai, 1999; Lin, Chiu and Chu, 2006).
- Competency: This dimension refers to the ability to apply suitable technology and the ability to increase innovation (Sharif and Zhang, 1999; Lin, Chiu and Chu, 2006).
- Responsiveness: This dimension emphasises the identification of changes and the ability to respond quickly to them (Goldman, Nagel and Preis, 1995; Swafford, Ghosh and Murthy, 2006; Jain and Gupta, 2016).

The current research has focused on the agility dimensions as the research context is the food industry and being agile is important for these specific products. In addition, the food industry has a special place in the Australian economy so it is essential to concentrate on agility and its specific features such as flexibility, innovation (competency) and responsiveness to appropriately meet customer demand. Therefore, it is important to know how firms can be agile in their environmental practices and, in turn, in achieving firm performance. Moreover, studies in the literature on agility and green practices are still rare, thus, presenting another good reason to conduct this study. In summary, the application of these agility capabilities can effectively support GSCP development.

- **Agility and the green supply chain**

The integration of the green supply chain and agility forms a very strong model for enabling markets to efficiently handle uncertainties (Jain and Gupta, 2016; Lakshmi and Visalakshmi, 2012). Green supply chains are complex and characterised by

several activities and different challenges (Kanda and Deshmukh, 2008). To meet these challenges, green supply chain partners should be able to appropriately respond to unpredictable changes, with this known as “agility” (Pankaj and Gupta, 2016). Therefore, thoroughly understanding what and how the “agile” concept can improve GSCPs is an important issue (Azevedo, Carvalho and Machado, 2016).

Agility is an important matter in the food industry as food is a perishable and time-sensitive product (Silva et al., 2018). At the same time, environmental demands are growing from buyers who require food producers to become agile to meet their requests. Buyers’ environmental requirements can impose more cost on suppliers which is not what they want. Therefore, it is important to understand how the agile capability can develop GSCPs at the least cost.

While it is acknowledged that extensive studies have been conducted on the definition, concept and capability of agility, the literature on the relationship between agility and GSCPs is rare (Green et al., 2012). For example, Jain and Gupta (2016) presented a model to analyse the interrelationship between GSCM and agility. These authors stated that a strong relationship exists between agility and GSCPs owing to the need to manage environmental uncertainty. In their study, Jain and Gupta (2016) introduced certain factors that could affect green supply chain agility with these comprised as follows: improvement of organisational integration; willingness to make improvements; collaborative relationships; flexibility in the system; responsiveness; customer satisfaction; and the commitment of top management (Jain and Gupta, 2016). In contrast, Azevedo, Carvalho and Machado (2016) emphasised that green purchasing and cooperation with consumers were not interrelated with agility. These authors mentioned GSCPs from the viewpoint that only internal environmental management was related to green supply chain practices (GSCPs). The current research extends the works of Azevedo et al. (2013) who proposed two indexes: an “Ecosilient index” to assess the greenness and another index to measure the agility of the organisation and its supply chain.

In a later study, Mirghafoori, Andalib and Keshavarz (2017) presented a conceptual model to investigate the relationship between agility and firm performance. The result revealed that supply chain agility, in terms of applying new technology and cooperation, is an essential factor for organisations if they want to develop green products and, in turn, firm performance (Mirghafoori, Andalib and Keshavarz, 2017). Therefore, based on the previous literature, it appears that agility is an essential internal supply determinant which can empower an organisation and its supply chain to improve green supply chain practices (GSCPs).

2.5.2.2 Internal supply relationship concept and definition

Establishing an appropriate relationship between supply chain partners enables organisations/supply chains to be more efficient and more effective (Kalwani and Narayandas, 1995). The main reason is that this relationship leads to the development of "connections between resources and actors, the complementary nature of the activity structures and the bonds established between individual actors" (Ford et al., 1998). Developing long-term relationships can enable organisations to access more reliable market information and to ease their way into entering new markets (Low, 1996). In addition, proper relationships in the supply chain have a significant role in improving innovation, such as green innovation. In fact, the green paradigm requires more involvement between supply chain partners (Pujari, 2006) due to the exchange of resources and the need to obtain accurate information (Noci and Verganti, 1999). Based on the literature, the relational norms commonly employed in supply chains are cooperation (Liu, Huang and Tang, 2008; Luo, 2007); trust; and commitment (Morgan and Hunt, 1994). In the following paragraphs, these factors are described in detail.

The supply chain literature provides strong evidence that trust is viewed as a critical determinant for a good relationship (Dwyer, Schurr, and Oh, 1987; Morgan and Hunt, 1994). Anderson and Narus (1990) described trust as the belief that the supply chain partner will perform actions that will result in positive outcomes for the firm and not take unexpected actions that may result in negative outcomes. Moorman, Deshpande and Zaltman (1993) defined trust as the willingness to rely upon an

exchange partner in whom one has confidence. With both definitions viewing trust as a behavioural intention that reflects reliance on the other partner, trust is seen as evolving from many favourable transactions with a supply channel partner (Dwyer, Schurr, and Oh, 1987).

Trust can develop communication (Morgan and Hunt, 1994), with communication in marketing channels decreasing the risk of the information exchanged, developing forecasting and promoting fast decision making (Anderson and Narus, 1990). Communication can be defined as "the formal as well as informal sharing of meaningful and timely information between firms" (Anderson and Narus, 1990, p. 44). It refers to the extent of information sharing and the level of participation in, and input into, joint concerns (Mohr and Spekman, 1994). Communication not only improves the supplier's credibility but may also provide a convenient and simple means of gaining knowledge of the supply market (Cunningham and Turnbull, 1982). By establishing proper communication, any uncertainty about a customer's or supplier's organisational structure, method of operation or technical expertise can be appropriately resolved.

Trust is also a critical factor for improving commitment (Christopher, 2000 and Ndubisi, 2011) which is an essential aspect of a long-term relationship (Hakansson and Snehota, 1995). Commitment "captures the perceived continuity or growth in the relationship between two firms" (Anderson, Hakanson and Janson, 1994, p. 10). It is defined as "an enduring desire to maintain a valued relationship" (Moorman, Zaltman and Deshpande, 1992, p. 316). Simply stated, trust can extend the willingness to remain within the terms of the contract with the firm's supplier. A firm that trusts its partner is more committed to their relationship (Morgan and Hunt, 1994). Trust and commitment encourage firms to work at preserving their investments in relationships by cooperating with exchange partners and to resist short-term alternatives in favour of expected long-term benefits (Morgan and Hunt, 1994).

Furthermore, trust can develop cooperation which requires mutual efforts by the parties. Cooperation can be defined as "similar or complementary coordinated

actions taken by firms in interdependent relationships to achieve mutual outcomes or singular outcomes with expected reciprocation over time" (Anderson and Narus, 1990, p. 45). Many studies have been carried out on internal organisational relationships, such as management and employee commitment (Lee, 2008; Walker, Di Sisto, and McBain, 2008; Zhu and Sarkis, 2006). However, research on the area of internal supply relationships is rare, and this research stream is only slowly developing (Sharfman, Shaft and Anex, 2009; Hoejmose, Brammer and Millington, 2012; Hassan et al., 2016). For example, Sharfman, Shaft and Anex (2009) empirical study investigated the role of internal relationships in terms of trust to improve supply chain environmental management among European firms. In their study, they focused on gaining an understanding of whether trust is an important factor in improving environmental practices between firms and their suppliers (Sharfman, Shaft and Anex, 2009). Similarly, the study by Hoejmose, Brammer and Millington (2012) examined the role of internal relationships in terms of trust and long-term relationships with suppliers in developing GSCPs among UK manufacturing. In a similar vein, Hassan et al. (2016) conducted a study with the aim of understanding the impact of supply chain integration on developing GSCPs and performance in sustainability. In the study by Hassan et al. (2016), supply chain integration is mainly related to cooperation, collaboration, sharing information and developing partnership. Hence, based on that study, the internal supply relationship is an effective dimension of internal supply determinants.

In summary, in Section 2.5, the literature about internal supply determinants has been reviewed. Table 2.2 presents the main internal supply determinants that influence GSCP adoption. Based on the extensive literature review, it is apparent that empirically validated and integrated measurement for a multidimensional model of internal supply determinants is still rare. Hence, the current research sought to develop a valid multidimensional measurement of internal supply determinants that influence GSCP adoption.

Table 2.2: Internal supply determinants influencing GSCP adoption

Research issue	Study method/s	References
Considers the interrelationship between agility and GSCM	Matrix	Jain and Gupta (2016)
Considers the relationship between GSCPs and agility	Delphi technique	Azevedo, Carvalho and Machado (2016)
Considers the relationship between agility, green products and firm performance	SEM	Mirghafoori, Andalib and Keshavarz (2017)
Studies the role of internal relationships in terms of trust in developing GSCPs	Regressions	Hoejmose, Brammer and Millington (2012)
Considers the components of internal relationships such as trust in developing GSCPs	Regression	Sharfman, Shaft and Anex (2009)
Studies the components of internal supply determinants in terms of trust as an GSCP antecedent	Framework	Hassan et al. (2016)
Considers agility as the antecedent of GSCPs	Case study	Lakshmi and Visalakshmi (2012)

2.6 GREEN SUPPLY CHAIN PRACTICES (GSCPs)

Green supply chain management (GSCM) is a successful sustainable development that can improve organisational performance through implementing its valuable practices (Rao and Holt, 2005; Wu, Ding and Chen, 2012). In their study, Zhu, Sarkis and Lai (2008) introduced various green practices, such as eco-design, investment recovery, green purchasing and internal environmental management (IEM) (with the latter including environmental management systems (EMSs), total quality management (TQM), management commitment and employer commitment), which had been applied by extensive studies in the previous literature (Lee , Kim and Choi, 2012; Lo and Shiah, 2016; Younis, Sundarakani and Vel, 2016). However, detailed research on green purchasing, EMSs and TQM is scarce. Therefore, the current research has focused on these factors, with GSCPs consisting of these three interrelated dimensions and existing in multidimensional domains as higher-order constructs. At the second-order level, GSCPs are measured by first-order constructs, namely, green purchasing, total quality management (TQM) and environmental management systems (EMSs). Green supply chain practices (GSCPs) are described in detail below.

2.6.1 Green purchasing

Green purchasing (GP) began as an important component of environmental and supply chain strategies for organisations during the 1980s and 1990s (Dowlatshahi, 2000). Green purchasing was shaped mainly by increasing pressure from factors such as regulations, stakeholders and NGOs owing to environmental problems that affected purchasing policies (Lindroos, 2015; Min and Galle, 2006). The various definitions of green purchasing have focused on several aspects of this concept. Min and Galle (2001, p. 1223), through a study on US manufacturing organisations, defined green purchasing as "an environmentally-conscious purchasing practice that reduces sources of waste and promotes recycling and reclamation of purchased materials without adversely affecting performance requirements of such materials". Based on this definition, the following elements are essential: forming a panel of environmentally certified suppliers; developing collaboration between them; developing technical skills and standards for purchasing raw materials; and paying attention to recyclable packaging. The current research relies on the definition above by Min and Galle (2001, p. 1223).

Overall, without green purchasing activities, a firm will not be successful in its environmental performance (Zailani et al., 2012). Green purchasing covers significant environment-based initiatives, such as environmental auditing of suppliers, assessing suppliers' environmental certification (Hu and Hsu, 2008) and developing collaborative relationships with suppliers in relation to environmental activities (Darnall, Jolley and Handfield, 2008; Paulraj, 2009) with these practices providing safe materials for buyers (Lee, Kim and Choi, 2012). A firm's networks with other organisations can impact on the environmental performance of these other organisations (Eltayeb, Zailani and Ramayah, 2011). In this regard, the firm needs to comply with environmental regulations to protect itself from devastating environmental effects involving its suppliers and to ensure that it receives environmentally friendly materials from suppliers (Zailani et al., 2012). For example, In the UK, legal regulations have been imposed requiring power generation firms to

purchase environmentally friendly resources in which the raw materials conform to the non-fossil fuel obligation (Chen, 2005).

Green purchasing in the food industry has a significant role to play in protecting the environment and comprises noteworthy activities such as: prohibiting products packaged in non-recyclable packaging; stipulating preferences to work with specific certified suppliers; and requiring compulsory information instruments, such as the declaration of environmentally hazardous materials (Brah and Schelleman, 2000).

In Australia, a few voluntary plans are available such as "Good Environmental Choice" which is implemented by the Australian Environmental Labelling Association to control purchased materials (Environmental Purchasing Guide, 2003).

Green purchasing brings more benefits to organisations, with these benefits related to improving the firm's economic position by cutting waste, reducing the disposal of waste and conserving resources, with these measures increasing the firm's reputation, reducing costs and developing greater efficiency (Ramakrishnan, Haron and Goh, 2015). Despite the benefits of green purchasing, organisations always face barriers to its implementation. These barriers are mainly regarding to the high cost of environmental programs (Min and Galle, 2006); suppliers' stress about new orders (Zhu, Sarkis and Lai, 2007); a decreased number of qualified suppliers due to stricter environmental quality standards (Min and Galle, 2001); and lack of managerial support (Walker, Di Sisto, and McBain, 2008).

Numerous studies have considered green purchasing as an essential dimension of GSCM and firm performance (Zhu, Sarkis and Lai, 2008; Hassan et al., 2016; Laosirihongthong, Adebanjo and Tan, 2013 and Muma et al., 2014). Most studies have emphasised green purchasing as a prominent part of GSCPs in different areas and different contexts. For example, in Zhu, Sarkis and Lai (2008) study, the GSCP construct, including green purchasing, was empirically examined in Chinese manufacturing. In the current study, green purchasing, through factors including auditing each supplier's environmental activities; requesting each supplier's

approved environmental certification; and cooperating with suppliers on environmental activities were introduced as strong GSCP dimensions.

The current research is in line with Lee, Kim and Choi (2012) study of Korean electronics firms. In that study, Lee, Kim and Choi (2012) considered the importance of green purchasing through its capabilities, followed by its relationship with firm performance. In addition, Eltayeb, Zailani and Ramayah (2011) in their study of Malaysian manufacturing concentrated on green purchasing and its capability as a significant measure of GSCPs and in developing firm performance. Moreover, Muma et al. (2014) and Laosirihongthong, Adebanjo and Tan (2013) emphasised the importance of green purchasing measures in GSCPs and firm performance. In Muma et al.'s (2014) study, the relationship between green purchasing and the development of green manufacturing, green marketing and green distribution in tea processing in Kenya was considered. These authors stated that the adoption of green purchasing could reduce environmental pollution and decrease the cost of environmental management (Muma et al., 2014). In Laosirihongthong, Adebanjo and Tan (2013) study, the significant role of green purchasing in GSCPs and in the development of firm performance was considered. In summary, based on the literature, it appears that green purchasing is a significant dimension of green supply chain practices (GSCPs).

2.6.2 Total quality management (TQM) overview

Quality is not a new concept as it has been practised through the ages since the time of the first civilised people (Elassy, 2015). In fact, the reasons that encourage organisations to adopt quality practices and to implement quality management systems (QMSs) are customers' demands for higher-quality products and services. Total quality management (TQM) is a philosophy that has been greatly debated in management science: it assists organisations to achieve success through customer satisfaction from both internal (employee) and external (business partner) efforts (Ahmad et al., 2015). Put simply, the TQM approach is based on the holistic application of quality and covers all areas of the organisation including its external relationships (Gucanin, 2003, p. 23). It is not just a fancy topic: many organisations

could survive near-failure (Ahmad et al., 2015) through TQM's benefits, such as eliminating defects; reducing rework; reducing costs; improving efficiency and productivity; and increasing employee motivation (Ahmad et al., 2015).

Total quality management (TQM) gurus, such as Juran, Crosby and Deming, presented their own TQM definitions. Juran (1989) defined quality as "fitness for use" and focused on the trilogy of quality planning, quality control and quality improvement. In a similar vein, Crosby (1996) stated that quality is "conformance to requirements or specifications" based on customer needs. Referring to Deming (1986), quality is a predictable degree of uniformity and dependability, at low cost and suited to the market. This author emphasised that quality principles can improve the productivity and performance of the organisation.

On the other hand, some studies in the literature have defined TQM based on its practices, relying mainly on the case studies and personal prescriptions of the famous gurus and their contributions in the management science domain to improve profits (Mokadem, 2016). However, no agreement has yet been reached about the real factors that comprise TQM, and disagreements will always continue about how to best cut the TQM cake into principles. The definition based on TQM practices is closer to the scope of the current research as it focuses on various significant aspects which can develop a firm's environmental practices. These practices, based on the literature, are:

- Management and employee commitment (Zhu, Sarkis and Lai, 2007): In this context, this factor demonstrates that top management and employees are actively involved in developing and communicating goals and plans for a quality program which encourages and motivates employee involvement in quality management activities (Mardani et al., 2013).
- Continuous improvement (Wiengarten et al., 2013; Conca, Liopis and Tari, 2004): This factor relates to quality improvement which coordinates and improves different activities of the firm such as procedures and instructions to guide and maintain consistency in these activities (Samat, Saad and Ramayah, 2006).

- Process management (Salaheldin, 2009): This factor involves standardised and well-documented operating procedures and the effective performance of inspections on incoming raw materials and final products (Baye and Raju, 2016).
- Benchmarking: This factor refers to structured problem solving, and the identification of processes and opportunities for future improvements (Mokadem, 2016). Benchmarking with a competitor's performance can improve customer satisfaction (Tasopoulou and Tsiotras, 2017).
- Customer focus: This factor involves paying more attention to customer requirements (Demirbag et al., 2006 and Shahin and Dabestani, 2011).

2.6.2.1 Total quality management (TQM) and supply chain management (SCM)

A strong linkage is found between total quality management (TQM) and supply chain management (SCM). Hence, understanding the relationship between TQM and SCM is essential for organisations (Casadesus and Castro, 2005; Vanichchinchai and Igel, 2009) as they both play an increasing role in improving organisational competitiveness (Sila, Birkholz and Ebrahimpour, 2006). The TQM philosophy plays a significant role in a firm's market orientation by appropriately meeting customers' requirements, with this process able to develop the firm's performance (Prajogo and Sohal, 2006). This philosophy also encourages the reduction of costs; creation of high-quality goods and services; customer satisfaction; and employee empowerment (Gunasekaran and McGaughey, 2003, p. 361). In the same way, SCM is a management philosophy that indicates how "to manage the total flow of a distribution channel from supplier to customer" (Ellram and Cooper, 1993).

In other words, TQM emphasises internal customers (employee and ownership involvement) while SCM requires internal and external business process integration across the supply chain (Vanichchinchai and Igel, 2009). Overall, integration between TQM and SCM is essential for the organisation, but it is not sufficient on its own (Hervani, Sarkis and Helm, 2005). Today, new challenges are emerging, with organisations being forced to leave their supply chains if they do not become green due to growing attention towards environmental issues, changes in consumer

awareness and preferences, regulations and pressure from NGOs (Wiengarten and Pagell, 2012).

2.6.2.2 Total quality management (TQM) and green supply chain management (GSCM)

Significant integration occurs between the total quality management (TQM) philosophy and the green supply chain (Zhu, Sarkis and Lai, 2008; Muduli and Brave, 2013). The TQM philosophy is a valuable approach that is widely employed to manage systems and process as well as to manage the environmental process which is a crucial issue for industries and for the world (Boccaletti and Borri, 1995). Industries are being forced to pay more attention to environmental issues and to include their ways of addressing these issues in their strategies if they want to remain in the market (Boccaletti and Borri, 1995). With the aim of eliminating defects and decreasing production costs, TQM is an important management tool that can assist the organisation or supply chain to address environmental issues (Ahmad et al., 2015). Hence, efforts to eliminate pollution and waste through environmental practices can follow the same basic principles that are applied in TQM, such as using inputs more efficiently, eliminating the need for hazardous, hard-to-handle materials, and avoiding unnecessary activities. Overall, as both systems share a similar focus, it makes sense to use TQM practices when implementing environmentally friendly practices (Moliner et al., 2012). Moreover, some researchers have termed this integration "total quality environmental management (TQEM)" (Sarkis et al., 2016) as both TQM and environmental management are strategic initiatives that need to be properly integrated within the business for the initiatives and the business to be successful (Corbett and Klassen, 2006).

Research on the connection between TQM and environmental development has matured since the 1992 Rio Earth Summit. However, studies in the literature about both GSCPs and TQM are rare. Some authors have highlighted critical linkages between quality management and environmental practices as well as performance in different contexts (Zhu and Sarkis, 2004; Corbett and Klassen, 2006; Sarkis et al., 2016). For example, Zhu and Sarkis (2004) conducted a significant study within

various Chinese manufacturing firms to determine the role of TQM as a moderator of the relationship between green practices and organisational performance.

In addition, Corbett and Klassen (2006) proposed a mechanism to provide evidence of the interaction between TQM, SCM, green performance and firm performance. In that study, Corbett and Klassen (2006) reviewed many studies on the importance of the role of TQM in internal coordination to improve firms' environmental performance. Corbett and Klassen (2006) highlighted the lack of research in this area and the pressure to align environmental research with total quality management (TQM). In a later study, Sarkis et al. (2016) considered TQM to be a significant GSCP dimension. In that study, Sarkis et al. (2016) emphasised TQM principles, such as customer focus, continuous improvement, people involvement and elimination of environmental risk, for the improvement of environmental management practices. Sarkis et al. (2016) also mentioned that studies about the relationship between TQM and green practices are still scarce. From that study, it can be seen that TQM is a significant dimension of green supply chain practices (GSCPs).

2.6.3 Environmental management

Environmental management is known as a strategic management approach that shows how firms can impact on the environment (Tabesh, Batt, and Butler, 2016; Darnall, Jolley and Handfield, 2008). The term "environmental management system (EMS)" emerged at the 1992 Rio Earth Summit, with the summit aiming to compel organisations to commit to environmental quality (Massoud et al., 2010). The growing consideration of environmental issues requires that organisations today practise environmental management to improve business management (Sharma, Chandanaand and Bhardwaj, 2015). Environmental management defines as 'that part of the overall management system which includes organizational structure, planning activities, responsibilities, practices, procedures, process, and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy" (Nickerson and Viana 2002, p.5). Once an organisation implements an EMS, it may choose to be ISO 14001 standard-certified with this standard developed by the International Organization for Standardization (ISO) in 1996 (Darnall, Jolley and Handfield, 2008).

As a process standard, ISO 14001 specifies the features of the components of a management system. ISO 14001 requires the adopting organisation to: create an environmental policy; set objectives and targets; implement a program to achieve environmental objectives; monitor and measure the program's effectiveness; correct problems; and conduct reviews aimed at improving the EMS (Massoud et al., 2010). Over the years, market drivers such as customer preferences, supply chain partners and regulation have encouraged organisations to be ISO 14001-certified (Hillary, 2004). The other reason relates to the benefits associated with pollution reduction which is viewed as acceptable by society (Coglianese and Nash, 2001). An organisation that is ISO 14001-certified can increase customers' trust as this certification demonstrates that the organisation is implementing practices such as waste reduction, cost reduction and decreased consumption of energy and materials (Hu and Hsu, 2008).

In Australia, more attention has been paid to environmental issues since the country ''was ranked as one of the world's highest rates of greenhouse gas emissions per person'' (Mazengarb, 2017). Hence, it is essential for organisations to pay more attention to establishment of EMS/ISO Pena, Garrido and Lopez (2014) and is a good reason to focus on this factor.

Many studies have been undertaken to identify EMS benefits in different contexts and different countries (Chan, 2008; Hillary, 2004; Massoud et al., 2010). Based on the literature, the greatest benefits from implementing an EMS are as follows: increasing the motivation of personnel through developing communication with and knowledge among employees (Hillary, 2004); quality improvement via training which develops innovation (Fisher, 2003) and increases market share (Hillary, 2004); cost saving (Massoud et al., 2010; Hillary, 2004); improvement of firm image and establishment of a good reputation (Hillary, 2004; Zutshi and Sohal, 2004); increase in the number of new customers and creating better relationships with shareholders (Zutshi and Sohal, 2004); improving social commitment; and preserving the environment (Hillary, 2004).

Even though implementing an EMS brings organisations many benefits, they may face some difficulties in its adoption. Based on the literature, these problems are mainly related to: the importance of other firm priorities (Hillary, 2004); lack of commitment of top management to environmental preservation (Chavan, 2005); lack of financial resources; lack of training, and high cost of investments (Fisher, 2003 and Hillary, 2004).

2.6.3.1 Environmental management system (EMS) and green supply chain management (GSCM)

A complementary relationship is present between the environmental management system (EMS) and green supply chain management (GSCM) as, together, they can give environmental sustainability an inclusive meaning among supply chain partners (Darnall, Jolley and Handfield, 2008; Tabesh, Batt and Butler, 2015). Hence, in this research, the EMS is viewed as a significant GSCP measure. Both the EMS and GSCM rely on continuous improvement to decrease the firm's impact on the environment. The adoption of an EMS is recognised as a "springboard" for getting on board with green practices (Jiang and Bansal, 2003). An EMS can assist the organisation to easily address the environmental impacts of its supply chain. The reasons are related to significant EMS principles, such as employee training, knowledge sharing and teamwork, that can improve environmental management by eliminating inefficiencies, thus continually improving the organisation's environmental performance (Darnal and Edwards, 2006). Overall, EMSs offer a management structure that supports SCM decisions which affect the natural environment (Darnal, Jolley and Handfield, 2008).

In contrast, the implementation of GSCM practices extends to the entire value chain (from supplier to consumer). This means that GSCM activities are likely to include extensions to contact with more third parties than is the case with an EMS, with more skills and knowledge required beyond the EMS framework. The most common GSCM practices involve the organisation evaluating its suppliers' environmental performance to ensure the environmental quality of their products and analysing the

cost of waste in their operating systems (Handfield et al., 2002). The organisation also needs to inform buyers about its environmentally friendly activities (Handfield, Sroufe and Walton, 2005). Based on the above-mentioned issue, if an EMS is adopted in the absence of GSCM, the anticipated environmental benefits may be reduced. The reason is that the organisation's supply chain network will not share its environmental goals and that the environmental sustainability of any organisation is impossible without incorporating GSCM practices (Preuss, 2005).

A significant amount of research has been conducted on the GSCM–EMS linkage (Darnall, Jolley and Handfield, 2008; Testa and Iraldo, 2010; Diabat and Govindan, 2011; Sharma, Chandana and Bhardwaj, 2015). For example, Darnall, Jolley and Handfield (2008) examined the relationship between EMSs and GSCPs through a survey of US manufacturing. In that study, Darnall, Jolley and Handfield (2008) emphasised the significant capability of both the EMS and GSCPs to leverage continual improvement processes, to develop environmental prevention programs and, in cross-functional management, to advance product stewardship goals. In a similar vein, Testa and Iraldo (2010) investigated the GSCM–EMS relationship. In their study, research data were collected from a consortium of universities, research institutes and consultants coordinated by the Institute for Energy and Environmental Policy and Economics, Bocconi University in Milan, Italy. Their study emphasised that GSCM practice development in an EMS context is more efficient, as existing barriers can be overcome by extending the management.

Diabat and Govindan (2011) conducted an interesting study on critical factors for improving GSCM among aluminium producers in India. In their research, Diabat and Govinda (2011) considered the EMS as an effective GSCM measurement. In a similar vein, Sharma, Chandana and Bhardwaj (2015) attempted to verify and rank GCSM measurement in the food industry. In that study, 79 parameters were analysed and ranked based on each parameter's priority (Sharma, Chandana and Bhardwaj, 2015). The result highlighted that the EMS is weighted as the seventh priority which addresses its critical role in GSCM improvement. Hence, based on the previous literature, the EMS is known as a significant GSCP dimension.

In summary, Section 2.6 has discussed GSCP dimensions in terms of the EMS, TQM and green purchasing. Table 2.3 summarises previous studies in relation to GSCP dimensions. Although it is apparent that many studies have been conducted on GSCP dimensions, the empirically validated and integrated measurement for a multidimensional GSCP model is scarce. Therefore, this study seeks to fill this gap and to attempt to develop a valid multidimensional GSCP measurement.

Table 2.3: GSCP dimensions

GSCP measurement	Study model	References
Considers eco-design, green purchasing and reverse logistics as components of GSCPs to develop firm performance	Factorability of the correlation matrix	Eltayeb, Zailani and Ramayah (2011)
Considers the significant role of green purchasing in green practices (green manufacturing, green distribution and green marketing)	Multiple regression with ANOVA test	Muma et al. (2014)
Considers green purchasing, product-related eco-design, packaging and reverse logistics as components of GSCPs to develop firm performance	Multivariate linear regression	Laosirihongthong, Adebanjo and Tan (2013)
Considers the interaction of TQM, SCM and green practices with firm performance	Case study	Corbett and Klassen (2006)
Considers the TQM capabilities such as work culture, teamwork, top management support and firm performance as GSCM measures	Regression	Muduli and Brave (2013)
Considers the EMS as a GSCP measurement	Pearson's chi-square tests	Darnall, Jolley and Handfield, (2008)
Considers the EMS as an effective GSCM measure	Binary probit models; descriptive statistics	Testa and Iraldo (2010)
Considers the EMS as a driving factor for GSCP implementation	Structural self-interaction matrix	Diabat and Govindan (2011)
Considers the EMS as a critical GSCP measure	Analytic hierarchy process (AHP)	Sharma, Chandana and Bhardwaj (2015)

2.7 FIRM PERFORMANCE

The implementation of GSCPs can provide valuable opportunities to improve firm performance (Longoni and Cagliano, 2018; Zhu and Sarkis, 2004; Tippayawong Tiwaratreewitb and Sopadanga, 2015; Ali et al., 2017). Firm performance is measured

by using multiple outcomes including environmental performance (Govindan, Khodaverdi and Vafadarnikjoo, 2015; Zhu and Sarkis, 2004; Zhu, Sarkis and Lai, 2007); operational performance (Rao and Holt, 2005 and Vachon and Klassen, 2006); intangible performance; and economic performance (Wu et al., 2015; Rao and Holt, 2005; Zhu and Sarkis, 2004). Firstly, GSCPs are mostly related to environmental performance so investigating the GSCP impact on environmental performance is crucial. Secondly, financial issues and cost are major factors for every business, with businesses very much concerned about new technology and its related cost. Hence, this provides a good reason to analyse GSCP implementation and its impact on firms' financial performance. Thirdly, the literature on GSCP operational performance is rare so this provides another good reason to conduct research in this area. Finally, although working on all performance dimensions would be valuable, time limitations did not allow for this, so the current research has focused on the environmental, financial and operational dimensions as described in detail in the following paragraphs.

Firstly, this research has focused on environmental performance as GSCPs are tightly integrated with environmental issues; thus, addressing environmental performance is essential. Environmental performance refers to the ability of manufacturing plants to reduce waste and emissions into the air, and their ability to decrease the consumption of hazardous materials (Zhu, Sarkis and Lai, 2008). In the current research, environmental performance refers to emissions into the air, water consumption, waste reduction and energy consumption (Zhu, Sarkis and Geng, 2005; Zhu, Sarkis and Lai, 2012; Green et al., 2012).

Secondly, financial performance is another important aspect of firm performance with regard to GSCP implementation. In fact, financial performance has been chosen as the second aspect of performance analysis in the current study due to the importance of cost analysis for each individual firm activity. Financial performance refers to the "ability to reduce costs associated with purchased materials, energy consumption, waste treatment, waste discharge, and fines for environmental accidents" (Zhu, Sarkis and Lai, 2008). In the current research, economic performance

is measured based on operational cost, reduction in fines and lower fees for waste treatment (Zhu, Sarkis and Lai, 2008; Green et al., 2012; Zhu, Sarkis and Lai, 2012).

Finally, operational performance relates to the firm's capabilities to more efficiently produce and deliver products to customers (Zhu, Sarkis and Lai, 2008; Green et al., 2012). The reason for selecting this aspect of performance is that the current study has focused on specific GSCP dimensions, such as TQM and the EMS: referring to Zhu and Sarkis (2004), TQM and the EMS are the main factors of operational performance, so it is vital for the current study to analyse this aspect of performance. Several factors, such as decreasing inventory levels and improving product quality (Zhu, Sarkis and Geng, 2005), are considered in measuring the operational performance of firms and their supply chains. However, factors, such as producing high-quality products; producing a variety of product lines; on-time delivery; and lower inventory levels are the most widely cited parameters for assessing economic performance (Zhu, Sarkis and Lai, 2008, 2005; Green et al., 2012; Zhu, Sarkis and Lai, 2012).

On this point, it is worth considering that seeking to maximise the adoption of environmental practices followed by the improvement of environmental performance can negatively impact on other indicators, such as economic performance. For example, efforts by firms to improve environmental performance may increase costs (Green et al., 2012). However, it is important to appreciate that, in the long term, due to the development of environmental activities, the firm reputation and firm image will improve, thus covering the cost (Eltayeb, Zailani and Ramayah, 2011).

Significant studies have emphasised the relationship between GSCPs and firm performance (Yigit, Ipek and Muhittin, 2018; Eltayeb, Zailani and Ramayah, 2011; Green et al., 2012; Laosirihongthong, Adebanjo and Tan, 2013; Rahim, Fernando and Saad 2016). For example, in their study, Yigit, Ipek and Muhittin (2018) investigated the relationship between GSCM and different aspects of firms' performance including environmental, logistics, financial and marketing. In their study, Eltayeb, Zailani and

Ramayah (2011) also attempted to understand the relationship between GSCPs and firm performance. They considered the impact of GSCPs on firm performance in terms of economic, cost reduction and intangibles performance (Eltayeb, Zailani and Ramayah, 2011). Moreover, in the study by Green et al. (2012), the relationship between GSCPs and firm performance was investigated. Their study focused on the relationship between GSCP components and firm performance, measuring firm performance based on the economic, environmental and operational aspects.

In a similar vein, Laosirihongthong, Adebanjo and Tan (2013) focused on understanding the relationship between GSCPs and firm performance, by considering the impact of GSCPs as measured against the firm's environmental, economic and intangibles performance. Furthermore, in their study, Rahim, Fernando and Saad (2016) presented a framework for the influential role of GSCPs on firms' performance. They concentrated on GSCPs and firm performance based on customer satisfaction and organisational competency (Rahim, Fernando and Saad, 2016).

In the current study, the organisational performance construct consists of three interrelated dimensions and exists in a multidimensional domain which is a higher-order construct. At the second-order level, organisational performance is measured by the following first-order constructs: environmental performance, economic performance and operational performance. Based on previous studies, the organisational performance construct is in both first order and second order regarded as reflective (Green et al., 2012; Younis, Sundarakani and Vel, 2016; Sarpong, Sarkis and Wang, 2016).

In summary, Section 2.7 has considered the previous studies in relation to different aspects of firm performance. Table 2.4 summarises a significant number of studies on various aspects of firm performance. Based on the previous studies, firstly it is apparent that the study about GSCP–operational performance relationship is still rare. Secondly, the empirically validated and integrated measurement for a multidimensional construct performance is scarce. Therefore, the current study

seeks to fill this gap by considering the linkage between GSCPs and operational performance.

Table 2.4: GSCPs and firm performance

Performance measurement	Study model	References
Considers the performance dimensions such as environmental and economic	Factor analysis: regression	Longoni and Cagliano (2018)
Considers the performance aspects including economic, cost reduction and intangibles	Factorability of the correlation matrix	Eltayeb, Zailani and Ramayah. (2011)
Considers firm performance such as economic, environmental and operational	LISREL	Green et al. (2012)
Considers the organisation's performance components such as environmental, economic and intangibles	Factor analysis: regression	Laosirihongthong, Adebanjo and Tan (2013)
Considers the environmental, logistics, financial and marketing aspect of firm performance	DEMATEL method	Yigit, Ipek and Muhittin (2018)
Considers the performance components in terms of organisation competency and customer satisfaction	Proposed model	Rahim, Fernando and Saad (2016)

2.8 GAPS

The previous sections have considered the identification, definition and concept of external and internal determinants, GSCP dimensions and firm performance, as found in the literature review. Some studies have emphasised the relationship between external and internal determinants and GSCPs (Ali et al., 2017; Chiou, 2011; Lo and Shiah, 2016; Wu, Ding and Chen, 2012); and the relationship between GSCPs and firm performance (Rahim, Fernando and Saad, 2016; Laosirihongthong, Adebanjo and Tan, 2013; Younis, Sundarakani and Vel, 2016). Table 2.5 presents previous studies in detail. However, some gaps are apparent:

- Firstly, the lack of knowledge about the relationship between external determinants and GSCPs is apparent. For example, although Zhu, Sarkis and Lai, (2013) considered the relationship between external determinants and GSCPs, it is still not clear how EMSs and TQM can be developed by government. Hence, the current study tries to

fill this gap by investigating the impact of government support on EMS and TQM development.

- Secondly, previous studies have mostly concentrated on internal organisational determinants such as management commitment and the development of an organisational cross-functional team to develop GSCPs (Ali et al., 2017; Lo and Shiah, 2016). Only a few studies have considered the relationship between internal supply determinants and GSCPs (Hassan et al., 2016; Mirghafoori, Andalib and Keshavarz, 2017). For example, even though Mirghafoori, Andalib and Keshavarz (2017) conducted a study on the relationship between agility and firm performance, the influence of agility on GSCPs, such as TQM, EMSs and green purchasing, was not considered. Therefore, the current research has sought to fill this gap by considering the role of agility in the development of these green practices. Green et al.'s (2012) study considered GSCPs and firm performance but those researchers emphasised the need for more research on the role of agility to further develop this relationship.
- Thirdly, the literature on the relationship between external and internal determinants and GSCP development is insufficient. For example, Ali et al.'s (2016) study focused on the influence of external and internal determinants on GSCP development. However, in that study, the relationship between external and internal determinants in developing GSCPs was not considered. Therefore, the current research sought to investigate the relationship between these two groups of determinants and their impact on green supply chain practices (GSCPs). For example, it is essential to understand how government can impact on agility to develop GSCPs or how suppliers can develop internal relationships in terms of trust, communication and cooperation to develop green supply chain practices (GSCPs).
- Finally, multidimensional studies to thoroughly investigate GSCP antecedents and their relationships, GSCP dimensions and firm performance are very rare. Hence, the current study has attempted to fill this gap by designing a unique multidimensional model to empirically validate and integrate the measurement of GSCP antecedents, GSCP dimensions and firm performance.

Table 2.5: Comprehensive summary of the previous literature

Research issue	Antecedents		GSCP	Firm performance	Study model	References
	External	Internal				
Considers the impact of internal and external factors on GSCPs and firm performance	Regulations Market forces	Management and employees' commitment Expected business gains	Green purchasing Eco-design	Operations Brand image Financial	Structural equation modelling (SEM)	Ali et al. (2017)
Investigates the impact of the greening of suppliers on green innovation to develop firm performance		Suppliers	Product Process Management	Environmental performances	SEM	Chiou et al. (2011)
Investigates the impact of external and internal pressures on GSCPs	Regulations Customers Supplier competitors	Green reputation Firm's mission Support from managerial level	Purchasing Design manufacturing Logistics Internal environment management	No	Regression	Lo and Shiah (2016)
Considers the impact of external and internal pressures on GSCPs	Government Market pressures	Organisational cross-communication Management support	Green purchasing Eco-design Investment recovery	No	IBM Statistics SPSS	Wu, Ding and Chen (2012)
Investigates the impact of external and internal pressures on GSCPs	Government Clients Competitors	Internal pressures Support from managers Training and education	Green purchasing Eco-design Recycling Reverse logistics	No	Regression	Mohanty and Prakash (2014)

Investigates the impact of institutional pressures on GSCPs and firm performance among Chinese manufacturers	Government Industry Customers		Eco-design ISO 14001 Green purchasing Investment recovery	Environmental Economic Operational	SEM	Zhu, Sarkis and Lai (2013)
Investigates the impact of external and internal pressures on GSCPs	Regulations Customers Suppliers Competitors	Green reputation Firm's mission Management support	Purchasing Manufacturing design Logistics Internal management	No	Regression	Lo and Shiah (2016)

2.9 THEORETICAL JUSTIFICATION OF KEY CONSTRUCTS AND THEIR RELATIONSHIPS

This study model is conceptualised based on the extensive literature review and two theories, namely, institutional theory (IT) and the resource-based view (RBV). Institutional theory includes significant drivers, namely, coercive drivers and normative drivers (DiMaggio and Powell, 1983; Sarkis et al., 2013). Coercive drivers are those with powerful influential agency such as government organisations. Coercive drivers are those who support and force manufacturers to implement GSCPs via fines and trade barriers, as well as incentives for GSCM implementation (Rivera, 2004). In the current research on the food supply chain, the term "coercive driver" refers to government and how its support can improve green practices. Normative drivers refer to buyers' requirements and participation in environmental practices which can improve green performance (Nezakati, Fereidouni and Rahman, 2016). In the current research on the food supply chain, the term "normative drivers" refers to buyers' participation in green practices and their requirements for environmental and quality standards to be met by suppliers to enhance firm performance.

Institutional theory (IT) provides a theoretical lens through which to investigate how a firm addresses green practices with its existing external determinants (Zhu, Sarkis and Lai, 2013; Rasi, Abdekhodaee and Nagarajah, 2014; Nezakati, Fereidouni and Rahman, 2016; Adebanjo, Ahmed and Teh, 2016). For example, in Zhu, Sarkis and Lai's (2013) study, the role of coercive and normative drivers on GSCPs and firm performance was investigated. In addition, Rasi, Abdekhodaee and Nagarajah (2014) considered the influence of institutional drivers, such as suppliers, buyers and government, on GSCP practices, such as changes in management systems, processes and products. In a later study, Adebanjo, Ahmed and Teh (2016) emphasised the role of external drivers in terms of stakeholder and social pressures on the development of environmental practices. Under institutional theory (IT), the organisation can be forced to use its resources more wisely and can present itself to its stakeholders in an environmentally friendly way to enhance their competitiveness (Darnall, Jolley

and Handfield, 2008). However, lack of support from institutional drivers is known as a main barrier to develop GSCP (Gonzalez Torre et al., 2010).

The previously mentioned studies have mainly concentrated on the impact of institutional pressures on GSCM practices. However, an analysis of internal factors and of the interaction between external and internal drivers is essential for GSCP development. The resource-based view (RBV) was introduced as an appropriate theory for considering the importance of internal drivers (Barney, 1991). The RBV is mainly supported by logistics and SCM research (Bowersox, Closs and Stank, 1999; Lynch, Keller and Ozment, 2000). It is an excellent theory to apply in the GSCM field "due to the intangible nature of important firm resources" (Shang, Lu and Li, 2010). The main reason for applying the RBV is that institutional theory (IT) only covers external drivers; however, the RBV also covers intangible internal resources.

The term "intangible resources" is related to the knowledge of technology, skilled and qualified human resources, managerial capabilities, organisational culture, relationships, reputation and trade contracts while the term "tangible resources" refers to financial assets, plant and machinery, equipment, raw materials and physical resources (Wernerfelt, 1984; Barney, 1991). Simply stated, the RBV emphasises the firm's internal strengths and weaknesses. It deals with the firm's resources and capabilities which are the firm's main drivers for competitive advantage (Lynch, Keller and Ozanne, 2000). In addition, Hart (1995) stated that aligning the RBV to natural resource concepts extended the theory to become the natural resource-based view (NRBV) of the firm. The NRBV emphasises the firm's relationship with the natural environment: this includes areas such as pollution prevention and GSCM, with these being an important source of sustainability competitiveness (Menguc and Ozanne, 2005). A few studies have been undertaken from the resource-based view (RBV) to examine GSCM, particularly in the context of the food industry.

The current study fills the gap in the GSCM literature by examining the relationship between internal supply determinants in terms of internal supply relationships (trust,

communication, commitment and cooperation) and agility (flexibility, competency and responsiveness) to improve GSCPs and firm performance. This study has also investigated the relationships between external determinants, in terms of government, suppliers, buyers and buyer participation (based on institutional theory [IT]), and internal determinants (based on the RBV) to develop green supply chain practices (GSCPs). The above discussion has emphasised the fact that no single theory is sufficient for completing this study; instead, integration of the two theories mentioned can enrich the knowledge base to justify the interaction between external and internal supply determinants and their impact on GSCPs and firm performance.

2.10 DEVELOPMENT OF RESEARCH MODEL

As previously mentioned, this study model is conceptualised based on the extensive literature review and two significant GSCM theories, namely, the resource-based view (RBV) and institutional theory (IT). This model has four main constructs comprising: external determinants (based on institutional theory [IT]), internal supply determinants (based on the resource-based view [RBV]), GSCPs and firm performance. The rationale for using these two theories was explained in the previous section (Section 2.9). Based on the extensive literature review, the external determinants, namely, government, suppliers and buyers are known as external antecedents of green supply chain practice (GSCPs) (Wu, Ding and Chen, 2012; Zhu, Sarkis and Geng, 2005; Lo and Shiah, 2016; Thun and Muller, 2010). Furthermore, the agility and internal supply relationship is mentioned as a significant internal supply determinant (Hassan et al., 2016; Lakshmi and Visalakshmi, 2012; Sharfman, Shaft and Anex, 2009; Hoejmose, Brammer and Millington, 2012).

In addition, external determinants are effective factors for improving GSCPs through internal determinants (Holt and Ghobadian, 2009). A significant body of research studies has emphasised the relationship between GSCPs and firm performance (Laosirihongthong, Adebanjo and Tan, 2013; Muma et al., 2014; Eltayeb, Zailani and Ramayah, 2011). Hence, based on the proposed relationships discussed in the above sections, this study has developed the proposed model comprising GSCM antecedents, GSCP dimensions and firm performance.

The developed model, based as it is on the extensive literature review and the above discussions, is both significant and unique. The reason is that, in the extensive literature review, it was found that the thorough investigation of a multidimensional model with the above-mentioned constructs and dimensions is extremely rare. Hence, this unified model has attempted to fill this gap. Figure 2.2 shows the research model.

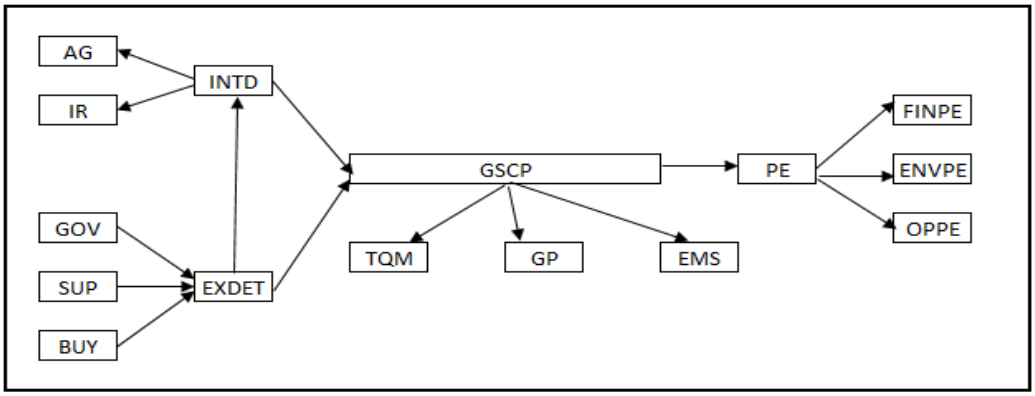

Figure 2.2: Research model

2.11 SUMMARY

This chapter presented the review of the literature for the current study. The relevant literature related to external determinants, internal supply determinants, GSCPs and firm performance was reviewed. Critical analysis of the literature was presented in each section, with the gaps found and explained in detail. In addition, this chapter described the development of the research model and of the various dimensions of each construct, as well as the interaction between them, based on the previous literature. The selected constructs in the model were justified based on the institutional theory (IT) and resource-based view (RBV) theory. The influential external determinants for improving GSCPs were explained by the concept of institutional theory (IT), whereas the justification of the internal supply determinants was through the resource-based view (RBV). Overall, based on the previous literature and the concepts of the RBV and institutional theory (IT), the comprehensive multidimensional research model, encompassing GSCP antecedents, GSCP dimensions and firm performance, is a unique contribution of this study.

CHAPTER 3

RESEARCH METHODOLOGY AND DESIGN

3.1 INTRODUCTION

In the previous chapter (Chapter 2), a conceptual framework was formulated to investigate the influence of external determinants and internal supply determinants on developing green supply chain practices (GSCPs) and, in turn, firm performance in the context of the Australian food industry. The aim of the current chapter is to provide an overview of research approaches and to describe the selection of an appropriate method for completing the current research. As described in Chapter 2, the findings in previous studies on GSCPs, their antecedents and firm performance are followed by two important theories, namely, institutional theory (IT) and the resource-based view (RBV), which lead to the creation of a unique model for this particular study on the Australian food industry.

The review of the previous literature revealed that research in the area of the green supply chain (GSC) and its performance has deployed quantitative methods (e.g., Ali et al., 2017; Hoejmose, Brammer and Millington, 2012; Y. Hassan et al., 2016; Lo and Shiah, 2016). In line with previous literature, the current study also adopted a positivist research philosophy and quantitative method to validate the study's conceptual model, analysing data and verifying the causal relationships between different factors in the research framework. In the current chapter, the selected research model is elaborated in detail. The research paradigm is firstly discussed which leads to the justification for conducting a quantitative study. Next, the research process using the quantitative method is described. The chapter concludes with a summary.

3.2 RESEARCH PARADIGM

The development of scientific practice based on researchers' philosophies about the world is known as a research paradigm (Collis and Hussey, 2003, p. 110). In fact, a research paradigm provides a comprehensive framework for each particular field and

elaborates the process of research design, data collection and data analysis and, finally, how findings are achieved. In other words, a paradigm refers to a set of guidelines that assists researchers to deal with first or final principles (Guba and Lincoln 1994, p. 108). The current study has explored three major research paradigms, namely, positivist, interpretivist and critical research, for their construction and development of knowledge (Guo and Sheffield, 2008).

Positivist studies engage in formal propositions, quantification and measurement of variables, hypothesis evaluation and design inferences about a phenomenon from the specific collected data (Orlikowski and Baroudi, 1991, p. 5). In other words, a positivist paradigm provides knowledge based on experiences gathered from verifiable empirical evidence owing to its support of theories and hypotheses (Denzin and Lincoln, 2005). Simply stated, the positivist paradigm is associated with reality and is free from researchers' ideas (Johnson and Onwuegbuzie, 2004, p. 16). In fact, the positivist approach is described as one in which "the data and its analysis are value-free and data do not change because they are being observed" (Krauss 2005, p. 760). The positivist paradigm is therefore associated with the quantitative research method which attempts to formulate and test the hypotheses (Creswell 2011, p. 58).

The second research paradigm is the interpretivist paradigm (Onwuegbuzie and Leech, 2005). The interpretivist approach attempts to draw science through its social context (Neuman, 2003, p. 163). Simply stated, the interpretivist approach places more emphasis on hearing, observing and feeling how knowledgeable people define an issue (Dwivedi, 2007, p. 53). In contrast to the positivist paradigm, the interpretivist approach rejects the disconnection between the researcher and the participant, as this approach relies on the researcher's interaction with participants and the researcher's impact on the issues being studied (Guo and Sheffield, 2008, p. 676). For interpretivist studies, the most suitable research process is the qualitative method as it relies more on observations than on reality (Creswell, 2003). The third category of research approach is critical analysis, with conflict and inconsistency the main features of this approach (Myers, 1997, p. 242).

The aim and nature of the current study determined the research paradigm and research method. As hypotheses were tested and assessed to find evidence, quantifiable measures of variables were used and inferences on an issue were illustrated from the selected sample to a stated population, this research considered the positivist paradigm appropriate.

3.3 RESEARCH METHOD

This study applied quantitative methods which have been used extensively in multidisciplinary studies on topics such as GSCM (Srivastava, 2007; Younis, Sundarakani and Vel, 2016; Ali et al., 2017; Lo and Shiah, 2016). Finding a suitable research method based on the research paradigm is essential as the selection of one that is inappropriate can result in inaccurate findings. Quantitative research methods provide a great opportunity for those researchers who are interested in using these techniques in practice (Johnson and Onwuegbuzie, 2005). The quantitative approach involves the measurement of variables and performance of statistical analysis based on numerical data (Smith, 1988). In addition, the quantitative method emphasises reality based on objectivism (Ollman, 2003). In fact, scientific hypotheses do not rely on people's values and are free of bias. In other words, subjective preferences based on people's attitudes have no place in the quantitative approach (Ting-Toomey, 1984). Moreover, the philosophy of applying the positivist paradigm is based on the objective (and measurable) truth that exists in the world. Hence, the best reasons for applying the quantitative paradigm are its measurement ability which is more reliable and generalisable, with greater clarity in the prediction of cause and effect (Cassell and Symon, 1994).

In particular, attention towards the quantity of formal modelling efforts is growing (Brandenburg et al., 2014), due to its advantages which comprise significant factors including:

- Defining the research problem in a very specific way
- Following the research goals, achieving more objective conclusions, testing hypotheses and determining the causality of variables;

- Minimising the subjectivity of judgement (Brandenburg et al., 2014).

3.4 JUSTIFICATION FOR RESEARCH PARADIGM

The current study sought to investigate the measurable and observable impacts of external determinants and internal supply determinants on green supply chain practices (GSCPs) and firm performance by positing the following research question:

How do the relationships between external determinants and internal supply determinants impact on the implementation of green supply chain practices and, in turn, firm performance?

This question emphasises the study's model-based nature as it has attempted to predict the relationships between the variables in the model, with these selected from the previous literature and considered to have the ability to support the study's theoretical relationships. In this study, several hypotheses were developed and tested based on quantifiable and measurable variables, with inferences drawn based on the statistical analysis of data collected from the sample respondents. Hence, it was considered that the quantitative method would be the best and most suitable method for this study. Simply stated, this study is prescriptive and confirmatory in nature which, therefore, relies on an 'objectivist' approach.

3.5 RESEARCH PROCESS

Studies on the relationships between external determinants, internal supply determinants, green supply chain practices (GSCPs) and firm performance are scarce. Hence, to undertake research in this area, the current study has employed a quantitative approach in the confirmatory phase. The entire research process is depicted in Figure 3.1.

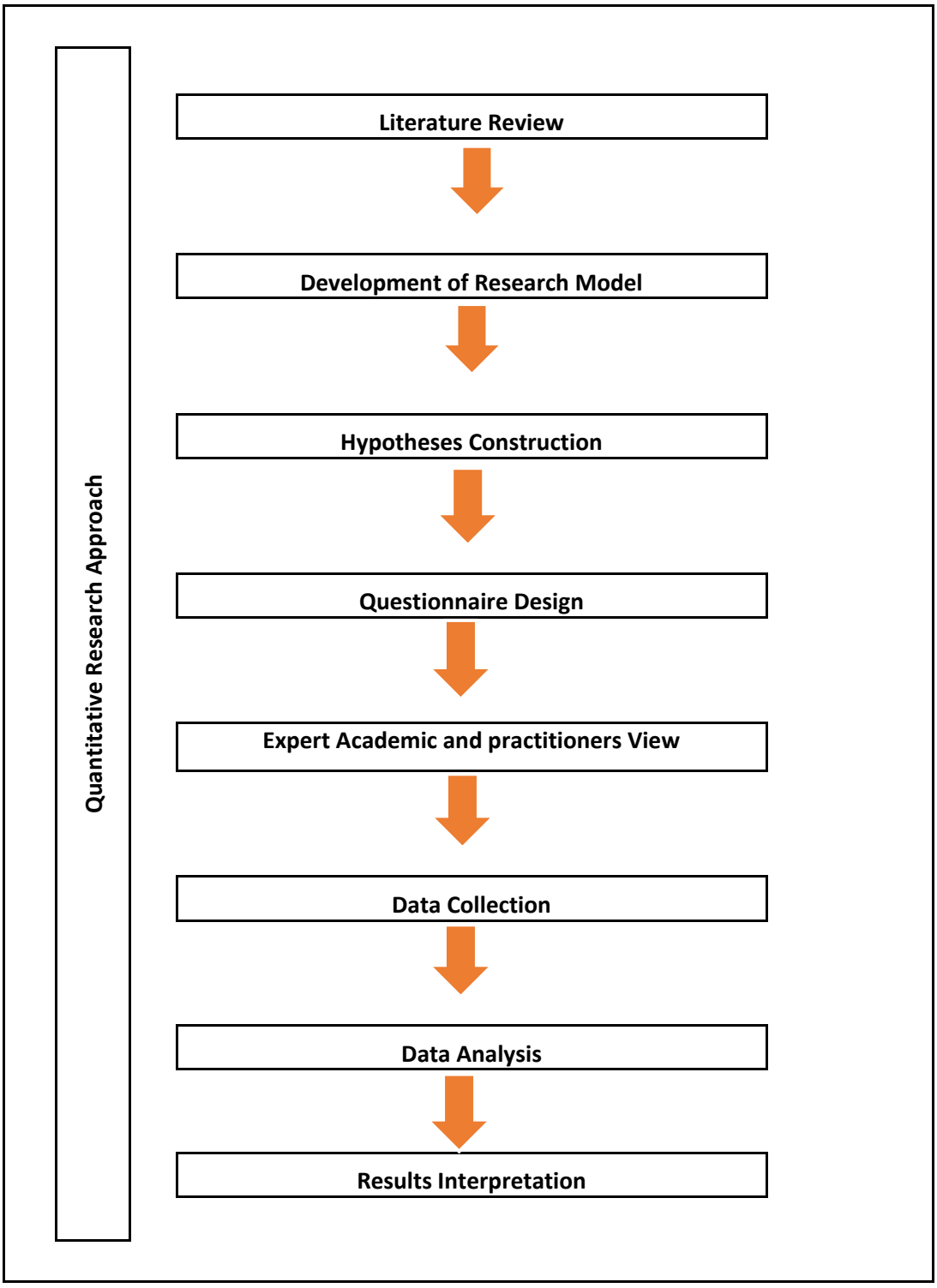

Figure 3.1: Research process

Step 1: Literature Review

The study's first step was a broad review of the literature on external determinants, internal supply determinants, green supply chain practices (GSCPs), and firm performance. The reviewed literature was from various sources comprising books, journals, conference papers and case studies. Research gaps were identified through this comprehensive literature review which was followed by defining the research objectives. In addition, as a foundation for developing the research model, two relevant theories were reviewed. These theories were in the domain of the GSCM literature, namely, the resource-based view (RBV) and institutional theory (IT), which concentrate on investigating the relationships between external determinants, internal supply determinants, GSCPs and firm performance (see Chapter 2 for a detailed explanation).

Step 2: Developing Research Model

In this step, a comprehensive research model was developed based on the literature review and two GSCM theories. All the constructs and sub-constructs, and the links between them, were justified based on the broad literature review.

Step 3: Hypotheses Construction

Based on the review of the relevant literature and theories, this step involved the justification of the relationships between each construct in the comprehensive model, with related hypotheses developed. Following this process, the developed measurement items and their references were described in regard to the previous literature. Finally, this step explained the pre-test procedure. The hypotheses development procedures are described in detail in Chapter 4.

Step 4: Questionnaire Design

In this step, the initial questionnaire was designed based on the four hypotheses developed in the earlier stage. The measurement items for each construct strongly relied on the available tools established in the previous literature. A tentative questionnaire was also designed using five-point Likert scales. The initial questionnaire was then subjected to a pre-test procedure to ensure the reliability

and validity of the measurement items before conducting the survey and wider distribution.

Step 5: Expert Academic and practitioners View

The initially designed questionnaire was sent to expert practitioners to refine the research questions before its distribution to respondents. This process was conducted with five food specialists and practitioners within the Australian food industry. This procedure aimed to obtain knowledge and feedback from the experts in their field to increase the content validity. Based on the received comments, the final questionnaire was then developed and distributed to respondents.

Step 6: Data Collection

The quantitative data collection was conducted through a questionnaire survey distributed by mail and email to Australian food directors and mangers. Respondents were selected by the role that affects the sampling method from the list in the Joint Accreditation System of Australia and New Zealand (JAS-ANZ)-certified Australian directory of the 100 best Australian food manufacturers. Managers responsible for implementing environmental measures in firms were targeted as respondents for the study's data collection. In total, 136 valid responses were collected. Of these respondents, 52 were managers who worked in EMS-certified companies; 63 respondents were from companies that did not have an EMS in place and 21 respondents were from companies in the processes of implementing an environmental management system (EMS). In this study, data from the 51 responses from respondents from firms with an EMS in place were considered for the PLS analysis.

Step 7: Data Analysis

The data collected through the mail and email survey were analysed based on structural equation modelling (SEM) using SmartPLS and SPSS (Ringle, Sarstedt, and Straub, 2012; Barclay, Higgins, and Thompson 1995). While PLS analysis tested for discriminant validity and convergent validity, as well as undertaking hypotheses testing, SPSS was used for descriptive analysis.

Step 8: Results Interpretation

In the final step of the research process, the results of the quantitative data analysis were discussed, with this discussion based on the previously developed research questions and objectives.

3.6 QUANTITATIVE STUDY

Once the refined model was finalised, the next step was to apply quantitative analysis to confirm and validate the factors and variables, as well as the links between the factors. The quantitative phase (or confirmatory phase) of this research was comprised of developing the hypotheses and the questionnaire; pre-testing the questionnaire; determining the sampling technique; collecting the quantitative data; and analysing the data through application of the quantitative analysis (PLS) method.

3.6.1 Developing the questionnaire

A questionnaire is a formal set of questions for collecting information from respondents (Malhotra, 2007, p. 85). A well-designed questionnaire has specific features including a suitable style, and appropriate language and symbols which can motivate respondents to accurately complete the questionnaire. However, even taking all these features into consideration cannot guarantee that the correct information will be collected, but it can assist the researcher to collect data with minimal mistakes in the responses. For researchers who are using the quantitative research approach, designing an appropriate questionnaire is very important. For the current study, a primary questionnaire was designed based on four constructs and five hypotheses. To ensure content validity, the measurement items for each construct were selected based on the previous literature. In addition, pre-testing was applied to evaluate and refine the questionnaire.

The other important issue in questionnaire development is selecting the appropriate scale. The current study is based on SEM empirical studies with most such studies employing the Likert scale for measurement of the items. A six-point Likert scale was used to collect measurement data based on the extent to which respondents agreed or disagreed with each statement (ranging from 1 = strongly disagree to 6 = strongly

agree or 1 = extremely low to 6 = extremely high). The reason for selecting the Likert scale is due to its easy preparation and interpretation, and its simplicity which assists respondents to answer the questions (Zikmund et al., 2012). The questionnaire design procedure is described in detail in Chapter 5.

3.6.2 Expert academic and practitioners view questionnaire

In this stage, the initial questionnaire was sent to four practitioners and one academic food specialist to modify and fine tune before distribution to the respondents. These respondents were asked to record the time taken to fill in the questionnaire. In addition, they were asked to present their suggestions for the addition or deletion of questions and to highlight any problems with the wording and the clarity of the questionnaire. Based on their suggestions and opinions, several modifications were made and the final version of the questionnaire was developed. For example, one of the practitioners suggested that "a definition of Green Purchasing will help to answer Question 14". Therefore, a definition of green purchasing in the section 2-C Question 14 has been added by researcher.

3.6.3 Study of population and sampling technique

The population in the current research can be defined as firms deemed to be Australian food manufacturers. As previously stated, this research aimed to develop a model of external determinants, internal supply determinants, green supply chain practices (GSCPs), and firm performance in the context of the Australian food industry. Firms that were small, medium-sized and large were considered for the data collection process. Research questionnaires were distributed in two waves, targeting three different groups. The survey data were collected by mail survey, through Australia Post, and web survey. The first wave of data collection used Australia Post. In the second wave, the developed web-based survey was distributed to firms through Qualtrics. Using this latter technique, managers were selected from their firm's website, with an invitation letter then sent to them via their LinkedIn page.

The scope of the study was clearly stated in the invitation letter which included the URL link to the survey in the message to respondents. Respondents were divided into

three groups: respondents who worked for EMS-certified firms; respondents who worked for firms without EMS certification; and respondents who worked for firms in the process of implementing an environmental management system (EMS). Data were analysed by structural equation modelling (SEM) and SPSS software. In addition, respondents were asked to pass the survey on to their colleagues in other food firms. Table 3.1 shows the sampling procedure for this study.

Table 3.1: Sampling procedure

Sampling process	Sampling strategy of the study	Comments
Target population	Food manufacturers	Food manufacturers have a role that affects the environment. Therefore, this study is focused on food manufacturers.
Sampling frame	Australia's food industry	The survey was distributed within Australia in South Australia (SA), New South Wales (NSW), Western Australia (WA), Victoria (VIC), Tasmania (TAS), Queensland (QLD), Australian Capital Territory (ACT) and Northern Territory (NT).
Sampling unit	Australian food firms; department responsible for environmental practices	The person responsible for environmental practice in the firm
Sampling elements	Managers responsible for environmental practice in firms	In some firms, the position of environmental management does not formally exist; however, the functions of environmental management are performed by the managers or the owner.
Sampling strategy	Purposive sampling	Three types of food manufacturers, large, medium-sized and small, are chosen.
Sample size	136 completed questionnaires	'52 responses': collected from respondents from firms with an EMS in place 63 responses': collected from respondents from firms not EMS-certified '21 responses': collected from respondents from firms in the process of implementing an EMS

3.6.4 Sample size determination

The number of respondents is a critical factor in determining the suitable utilisation of any statistical analysis to achieve the desired explanatory power of a conceptual

research framework. A partial least square (PLS)-based structural equation modelling (SEM) approach has been used in this study to measure the research dimensions and to test the formulated hypotheses in the proposed conceptual research framework. In this regard, careful consideration is needed when selecting a suitable sample size. When employing PLS for data analysis, it is important to observe the rule that the sample size should not be less than 10 times the number of items in the most complex, formative construct of the research model (Gefen, Straub, and Boudreau, 2000; Chin, Marcolin, and Newsted, 2003). Based on this rule the current study thus needed at least 30 responses (10 x 3) as the most complex formative construct had three items: green supply chain practices (GSCPs), internal supply determinants and external determinants. In this study, the total of 52 responses collected from respondents from firms with an EMS in place were considered adequate for the PLS analysis. This is more than the minimum sample size requirement of 30 that is aligned with the collected data analysed by using SPSS and PLS-SEM (Chin, 1998a; Ringle, Sarstedt, and Straub, 2012; Barclay, Higgins, and Thompson, 1995).

3.6.5 Survey distribution

For this study, respondents were selected from their firm's website and were then approached via LinkedIn and phone to obtain their approval. The survey's aim was explained to them and, if they were happy to participate, the questionnaire was sent to them based on their preference for mail, email, Qualtrics link or LinkedIn. Each questionnaire was accompanied by a cover letter explaining the study's purpose and the benefits for the food industry. Respondents mainly requested the option of completing the questionnaire anonymously. With most respondents very busy due to their management position, they were given three to four weeks to complete and return the questionnaires. After four weeks, phone calls were made or messages were sent through LinkedIn or email to respondents to encourage them to complete and return the questionnaire to the researcher. To improve the response rate, reply-paid envelopes were sent to all respondents to encourage them to mail the completed questionnaire.

3.6.6 Analysis of quantitative data by structural equation modelling (SEM)

As previously mentioned, this study was based on the quantitative approach and used the PLS-SEM technique.

3.6.6.1 Justification for using PLS-SEM for this research study

The most significant reasons for applying PLS-SEM are related to the small sample size, the formative measures and the focus on prediction (Hair et al., 2012). In other words, implementing PLS-SEM brought with it several benefits including, firstly, that PLS-SEM can manage the causal modelling that works by "simultaneously assessing the reliability and validity of the measures of the theoretical constructs and estimating the relationships among these constructs or variables" (Barclay, Higgins, and Thompson, 1995, p. 287). Secondly, PLS-SEM is appropriate for assessing the measurement properties of a construct when the research is based on theory development. Thirdly, PLS-SEM deals explicitly with measurement error. Moreover, it assists researchers with other benefits, such as multiple regressions, principal component analysis (PCA) and cluster analysis (Barclay, Higgins, and Thompson, 1995; Ullman and Bentler, 2012) that are not workable with first-generation techniques. Implementing first-generation techniques is not a suitable method for analysis owing to their limitations that prevent both creativity and in-depth data analysis (Barclay, Higgins, and Thompson, 1995). However, the second-generation tool based on the SEM method enables researchers to appropriately complete a comprehensive analysis by simultaneously modelling the relationships between different independent and dependent constructs (Chin, 1998; Ringle, Sarstedt, and Straub, 2012; Gefen, Straub, and Boudreau, 2000).

This research model includes many variables which cannot be comprehensively analysed by regression analysis. Hence, PLS-SEM, a second-generation data analysis technique, was applied to make a simultaneous assessment of the measurement properties and the structural model. In addition, this research collected data from a small sample to which it was suitable to apply the PLS technique. In addition, SEM has been successfully applied in models of green practices; however, these examples

are very limited. Furthermore, this study encompassed both reflective and formative items with PLS-SEM able to effectively handle all of their respective indicators (Rai, Patnayakuni, and Seth, 2006; Ringle, Sarstedt, and Straub, 2012).

This research was exploratory in nature as it was conducted to investigate the impact of internal supply determinants and external determinants on GSCPs and firm performance in the context of food manufacturing in Australia. The comprehensive research model developed by the study is both complex and unique. Hence, based on the above argument, PLS-SEM is considered the ideal data analysis method applicable to this study. To the best of the researcher's knowledge, no prior research has dealt in an integrated fashion with predicting the interrelationships between external determinants and internal supply determinants and their impact on improving GSCPs and firm performance.

3.6.7 SmartPLS procedures

Analysis using SmartPLS comprises two steps: the assessment of the measurement model and the assessment of the structural model (Hair et al., 2012; Ringle, Sarstedt, and Straub, 2012). The details of this analysis are described in Chapter 5. Assessment of the measurement model includes assessing the causal relationships between the constructs and their measurement items (variables) (Jarvis, MacKenzie, and Podsakoff, 2003; Igbaria, Guimaraes, and Davis, 1995, p. 96). The proposed model in this research involved reflective and formative measurement leading to calculations of the loadings that indicate the strength of the measures with the corresponding latent variables.

The structural model was assessed by analysing the relationships between the paths in the model (Igbaria, Guimaraes, and Davis, 1995, p. 96). The use of SmartPLS enabled the estimation of the path coefficients for the different paths in the conceptual research model. The results of this step indicated the explanatory power of the endogenous constructs as well as examining the *t*-values of each path coefficient of the theoretical relationships in the model as they corresponded to the hypotheses.

3.6.7.1 Description of reflective or formative measurement

The current research model considered both formative and reflective measurement constructs. In this regard, the description of both measurement models is essential due to bias in the results of their misspecification (Jarvis, MacKenzie and Podsakoff, 2003; Ringle, Sinkovics and Henseler, 2009). In the conceptual model, the different nature of the constructs plays a significant role in determining whether the construct factors are formative or reflective. The selection of the measurement model and the determination of whether any construct is formative or reflective needs an appropriate theoretical justification (Coltman et al., 2008). However, in some cases, selecting an appropriate measurement construct is difficult (Diamantopoulos and Siguaw, 2006). Referring to Chin (1998) and Hardin et al. (2008), choosing between reflective measurement and formative measurement mainly relies on significant issues, such as the research objectives, the substantive theory for the latent construct and the conceptual definition of constructs. The following paragraph describes the reasons for applying reflective or formative measurement.

Firstly, reflective measures are caused by the latent variable, so the direction of causality is from the construct to the items, whereas formative measures cause the latent variable, so the direction of causality is from the items to the construct (Jarvis, MacKenzie, and Podsakoff, 2003; Hardin et al., 2008). Figure 3.2 shows the reflective measurement model, while Figure 3.3 depicts the formative measurement model. Secondly, in reflective measurement, due to the causal nature of the relationship between each item and the latent variable, any change in the construct makes changes in the factors. Simply stated, the reflective model indicates that the measures are manifestations of constructs which means that all measures under a construct contain the same theme (Jarvis, MacKenzie, and Podsakoff, 2003; Polites, Roberts, and Thatcher, 2012). Hence, a high correlation between factors is established (Fornell and Bookstein, 1982). In contrast, formative items are not correlated to each other and measure underlying dimensions of the latent variable differently (Chin, 1998a). In this regard, item exclusion is a serious issue as the

elimination of an item can change the meaning of the construct (Jarvis, MacKenzie, and Podsakoff, 2003).

Referring to Jarvis et al. (2003), four significant decisions are generally employed for determining whether a construct should be modelled as a formative or a reflective indicator. These are:

(1) The direction of causality from construct to measure implied by the conceptual definition,

(2) Interchangeability of the measurement factors,

(3) Covariation among the factors,

(4) Nomological net of the construct factors.

Based on Jarvis et al., (2003) guidelines, the constructs used in the current research were a mix of reflective and formative. With reference to the previous literature, the constructs relating to green supply chain practices (GSCPs), firm performance and internal antecedents of GSCPs were considered to be reflective while external determinants were considered to be formative in nature. Table 3.2 presents the details of formative measurement in comparison with reflective measurement.

Table 3.2: Formative measurement vs. reflective measurement

	Formative model	Reflective model
Direction of causality between construct and measures/items	Direction of causality is from items to construct	Direction of causality is from construct to items
Whether the measurement items are defining characteristics or manifestations of the construct	Measurement items are defining characteristics of the construct	Measurement items are manifestations of the construct
Interchangeability of the measurement factors	Measurement items need not be interchangeable	Measurement items should be interchangeable
Covariation among the factors	Not necessary for items to covary with each other	Items are expected to covary with each other
Source: Jarvis et al. (2003)		

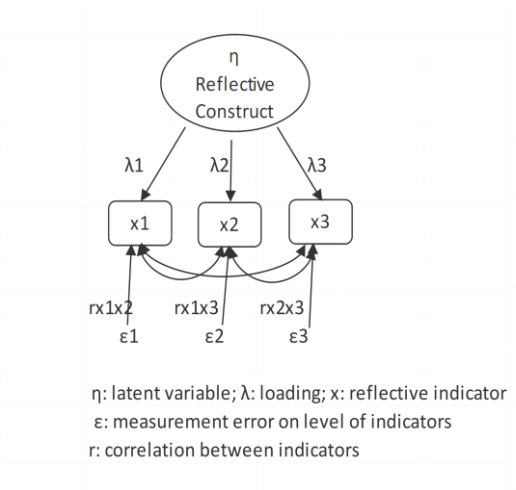

Figure 3.2: Reflective measurement model

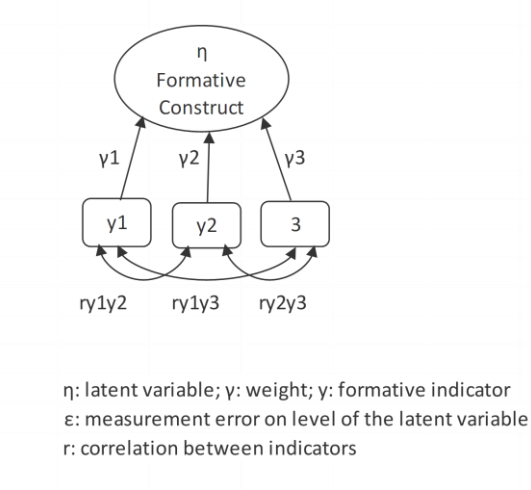

Figure 3.3: Formative measurement model

3.6.7.2 Assessment of reflective measurement model

The assessment of the relationships between a construct and its manifest variables is an important step (Igbaria, Guimaraes, and Davis, 1995, p. 96; Ringle, Sinkovics and Henseler, 2009) due to gaining an understanding of the extent to which the obvious indicators reflect their fundamental constructs (Santosa, Wei, and Chan, 2005, p. 363). The study evaluates the reflective measurement model to determine its suitability from the perspectives of both convergent validity and discriminant validity (Barclay, Higgins, and Thompson, 1995; Santosa, Wei, and Chan, 2005; Ringle, Sinkovics and Henseler, 2009). Convergent validity is assessed by examining:

a) item reliability
b) internal consistency
c) average variance extracted (AVE).

Discriminant validity is evaluated by:

- examining item cross-loadings for the construct
- comparing inter-construct correlations with the square root of AVE (Fornell and Larcker, 1981; Hair, Ringle, and Sarstedt, 2011).

In this step, findings from the previous literature were carefully compared. Redundant items and constructs were withdrawn, with critical items and constructs added. Finally, based on the earlier literature and the theories, the justification was presented for each selected construct, with its dimensions explained, followed by the proposal of the final research model. Table 3.3 shows the systematic procedures for SEM analysis.

Table 3.3: Systematic procedures for SEM analysis

Steps	Type of Item	Type of Measurement	Decision Parameter
		Convergent validity	
	Reflective	a. Item reliability	Item loading ≥ 0.7, *t*-value > 1.65
		b. Internal consistency	≥ 0.7

Step 1 Assessment of Measurement Model		c. Average variance extracted (AVE)	≥ 0.5
		Discriminant validity	
		AVE analysis	Square root of the AVE of a construct is larger than its correlation with other constructs
			Item loadings of construct is greater than all other cross-item loadings of the construct
Step 2 Assessment of Structural Model	Reflective	Coefficient of determination	R2 ≥ 0.25
		Test of hypotheses	Significant *t*-value = 1.65

- **Convergent validity**

In assessing the measurement model, the evaluation of convergent validity is considered the first step and is completed through the following three steps:

a) Item reliability

According to Barclay, Higgins and Thompson (1995, p. 295), item reliability assessment relates to the analysis of the estimation of the amount of variance for each individual item's measurement which is due to the construct. In other words, item reliability assesses the loading for each individual item within the construct to examine how well each item is related to its respective construct. Simply stated, item reliability measures the amount of variance for each individual item for its corresponding construct (Barclay, Higgins, and Thompson, 1995). Item loading is used to understand the strength of the items due to the measurement of a specific construct. Hence, items with high loadings designate high correlation between the items in the construct, whereas items with low loadings indicate low correlation between the items in the construct. Item reliability is assessed in PLS-SEM through evaluating the item loading scores and their significance through the reflective measurement model.

Various opinions have been expressed about the acceptance level for item loadings. For example, Hair, Anderson and Tatham (1998, p. 247) indicated that loadings higher than 0.3 were significant, those higher than 0.4 were more significant and those higher than 0.5 were very significant. In addition, in their studies, Chin (1998b) and Hulland (1999) considered that the item loading should be at least 0.5. Moreover, Chin (1998a, p. xiii) emphasised that the minimum acceptance for item loadings should be at least 0.6 and preferably 0.7 or more. Based on the previously mentioned literature, to maximise the convergent validity and increase the reliability of the measurement model in the current study, the value proposed by Chin (1998a, p. xiii) of 0.6 was designated as the acceptance level for item loadings.

b) Internal consistency

Internal reliability is measured by examining composite reliability (Fornell and Larcker, 1981, p. 42). In measuring reliability, a second-generation procedure developed by Fornell and Larcker (1981) has overcome the weaknesses of the first-generation reliability measure using Cronbach's alpha. This procedure is used to establish convergent validity to assure the unidimensionality and correlation between the items in a construct (Hair, Ringle, and Sarstedt, 2011; Fornell and Larcker, 1981). In the previous literature, just as varying acceptance value points have been supported, so to have arguments occurred about the cut-off point. For example, Ringle, Sinkovics and Henseler (2009) considered the minimum threshold of 0.60 to be the cut-off point value for internal consistency while other studies indicated that the minimum threshold should be at least 0.7 (Hair, Ringle, and Sarstedt, 2011; Fornell and Larcker, 1981; Barclay, Higgins, and Thompson, 1995; Hair et al., 2012). The current study adopted the minimum threshold of 0.60 for internal consistency. Internal consistency can be calculated by using the following formula where λi = the factor loading which represents the simple correlation between the item and its constructs, and Var (εi) = $1 - \lambda i^2$, the unique/error variance. Internal consistency was calculated by Equation 3.1:

$$\alpha = \frac{(\sum \lambda\gamma_i)^2}{(\sum \lambda\gamma_i)^2 + \sum Var(\varepsilon_i)}$$

Equation 3.1: Internal consistency

α= Internal consistency

λ = component loading of an indicator

γ = construct

i = item

Var (εi) = 1 – λ γi^2

c) Average variance extracted (AVE)

The average variance extracted (AVE) of a construct by its corresponding items is a useful way to assess construct validity (Fornell and Larcker, 1981; Hair, Ringle, and Sarstedt, 2011). Logically calculated to empower the statistical analysis, it measures the variance explained by a particular construct in regard to its indicators (Fornell and Larcker, 1981). According to Fornell and Larcker (1981, p. 46), the acceptable value for AVE is 0.5, with this value also supported by Hair, Ringle and Sarstedt (2011), Hair et al. (2012) and Ringle, Sinkovics and Henseler (2009). An AVE value of more than 0.5 refers to acceptable convergent validity as the latent variable is able to explain, on average, more than half of the variance of its indicators (Ringle, Sinkovics and Henseler, 2009). Equation 3.2 denotes the formula for calculating AVE as:

$$AVE = \frac{\sum \lambda\gamma_i{}^2}{\sum \lambda\gamma_i{}^2 + \sum Var(\varepsilon_i)}$$

Equation 3.2: AVE calculation

where

λ = component loading of an indicator

γ = construct

i = item

Var (εi) = 1 – λ i^2

- **Discriminant validity**

As previously mentioned, the second stage of the evaluation of the measurement model relates to the analysis of discriminant validity. According to Barclay, Higgins and Thompson (1995, p. 295), discriminant validity is the degree to which constructs in the model differ from each other. This statistically tests the degree of variance shared between constructs and items in the model. Referring to Fornell and Larcker (1981) and Ringle and Sarstedt (2011), the method for testing discriminant validity involves the following two procedures:

a. comparison between the square roots of the average variance extracted (AVE) of the constructs and inter-construct correlations
b. cross loading matrix evaluation at the item level.

Discriminant validity can be measured by comparison of the square roots of the average variance extracted (AVE) of the data sets to the inter-construct correlations. In a situation where data might form different constructs, it then prepares to extend beyond the construct. Referring to Fornell and Larcker (1981, p. 49), discriminant validity is acceptable if the AVE of a specific construct is more than the shared variance of its measures. Therefore, the variance shared between measures of two different constructs should not be more than the AVE for the data determining each construct (Fornell and Larcker, 1981, p. 49; Barclay, Higgins, and Thompson, 1995, p. 296; Santosa, Wei, and Chan, 2005, p. 366). The SmartPLS technique can evaluate discriminant validity through evaluating correlations at the levels of the data sets and the data: it presents and compares the results through a table format. Through the use of SmartPLS, cross-loadings for each set of data are investigated, compared across all existing data sets and then presented as a cross-loading matrix to show discriminant validity Chin (1998a, p. xiii, 1998b, p. 305) stated that the correlations of data, with respect to all data sets in the model including the construct that these data intend to evaluate, could be assessed by using SmartPLS cross-loading analysis.

3.6.7.3 Assessment of formative measurement model

Formative measurement is the best way to measure the explanatory combinations of factors in a case where each factor uniquely contributes to a specific construct, and

where one factor would not necessarily change the others (Hardin et al., 2008). With reference to Hair, Ringle and Sarstedt (2011), the validity of formative factors is established based on the theoretical rationale (Rossiter, 2002). In assessing the formative model at the level of its factors, it is essential to evaluate whether each factor contributes to the formative index by referring to its intended meaning. Two different approaches are used to determine the significance of indicator weight and loading for formative assessment. Firstly, Fornell and Bookstein (1982) considered the inclusion of all factors even if weight and loading were both insignificant. In contrast, referring to Hair, Ringle and Sarstedt (2011), the low-loading item is to be eliminated due to its lack of contribution to the construct during model estimation. The details are discussed in Chapter 5.

3.6.7.4 Assessment of structural model

After examining reliability and validity through assessment of the measurement model, the next stage is the assessment of the structural model (Hair, Ringle, and Sarstedt, 2011; Fornell and Larcker, 1981). In this stage, the statistical significance of the hypothesised relationships between constructs is analysed through appraising the descriptive power of the independent variables (R^2) and checking the direction of path coefficients and the value of *t*-statistics (Barclay, Higgins, and Thompson, 1995, p. 299; Santosa, Wei, and Chan, 2005, p. 366).

- **Amount of variance explained or R-squared (R^2)**

The predictive power of the research model is assessed through the R^2 values (Barclay, Higgins, and Thompson, 1995, p. 299). Simply stated, the term 'predictive power' refers to the explanatory power of each construct in the research model and is used to characterise the model's ability to explain and predict the endogenous latent variables (Ringle, Sarstedt, and Straub, 2012; Hair, Ringle, and Sarstedt, 2011). The R^2 values are provided through the bootstrapping results of running partial least squares (PLS) (Chin, 1998b, p. 302). In line with the guidance of Hair, Ringle and Sarstedt (2011), in the current study, the structural model has been assessed by examining the explanatory power of the proposed research model. According to Teo,

Wei and Benbasat (2003, p. 32), the accepted value of R^2 for endogenous latent variables can be 0.1 or above, with this accepted value used in the current study.

- **Path coefficients (β) and statistical significance of *t*-values**

In this study, two statistical assessments, namely, path coefficients β and *t*-values of the hypothesised relationships, were considered in assessing the relationships between the constructs as hypothesised in the research model (Hair, Ringle, and Sarstedt, 2011). Both two tests were obtained through an advanced non-parametric test called 'bootstrapping '(Gefen, Straub, and Boudreau, 2000).

3.7 SUMMARY

In this chapter, the researcher has sought to thoroughly describe the research methodology applied in the current study. Based on the overview and comparison of different research approaches, the best research method for this study on green supply chain management (GSCM) and the development of the study's specific research model is the quantitative approach, the measures of which are comprehensively discussed.

CHAPTER 4

HYPOTHESES AND INSTRUMENT DEVELOPMENT

4.1 INTRODUCTION

The previous chapter discussed in detail the quantitative approach, selected as suitable for the research methodology in this study. The chapter also provided complete justification for the selected sampling and analysis methods, namely, SPSS and PLS-based structural equation modelling (PLS-SEM). The current chapter describes in detail the development of hypotheses based on the relationships between the factors in the proposed research model. The hypotheses presented in this chapter are related to the constructs: external determinants (EXDETs) to green supply chain practices (GSCPs); internal supply determinants (INTDs) to GSCPs; EXDETs to INTDs; GSCPs to firm performance (PE). This chapter has also sought to provide the measurements for these constructs. The design of the research measurements is also discussed, with a table showing the measurement items with their respective references, followed by presenting the final questionnaire for the main survey. The proposed research model, discussed in Chapter 2, is presented in Figure 4.1.

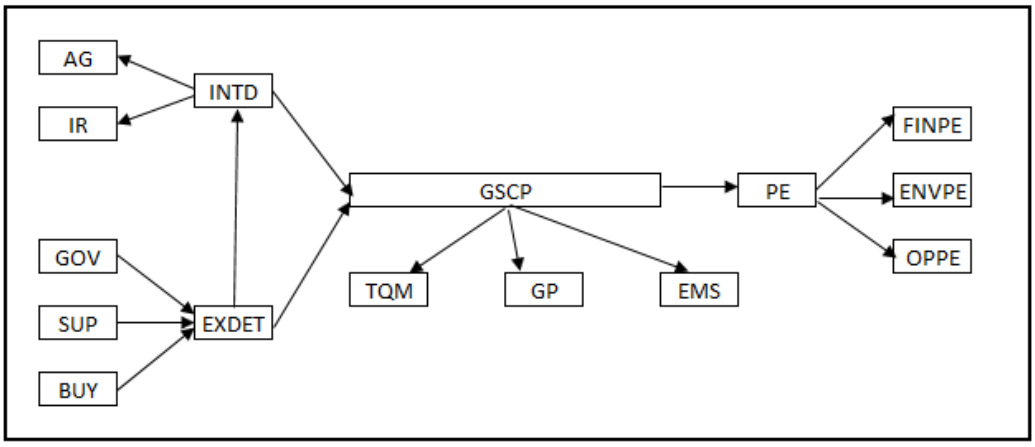

Figure 4.1: Research model

4.2. HYPOTHESES DEVELOPMENT

4.2.1 H1: Hypothesis of external determinants to green supply chain practices

Various external determinants are involved in the environment issue (Tachizawa Gimenez and Sierra, 2015; Ahmed and Najmi 2018Wu, Ding and Chen, 2012; Walker, Di Sist and McBain, 2008). Based on the previous literature, external determinants comprise the following three significant components: the government, buyers and suppliers (Lee, 2008; Lin and Ho, 2011; Hu and Hsu, 2010; Zhu et al., 2005). Also, as explained in Chapter 2, Section 2.9, the impact of external determinants (EXDETs) on GSCPs has been justified through the lens of institutional theory (refer to DiMaggio and Powell, 1983). This is supported in the previous literature by the works of Zhu, Sarkis and Lai (2013); Rasi, Abdekhodaee and Nagarajah (2014); Nezakati, Fereidouni and Rahman (2016); and Adebanjo, Ahmed and Teh (2016). Firms must know their external determinants to be able to appropriately respond and deal with them. In addition, each of the external determinants were not correlated and they were not regarded as interchangeable measurements. Hence, refer to Jarvis et al (2003) external determinants were measured by formative factors and caused the latent variable while the items defined the characteristics of the construct (Jarvis et al., 2003).

It has been acknowledged that external determinants play an essential role in developing GSCPs (Lee, 2008; Zhu et al., 2013; Lo and Shiah, 2016). In this regard, Firm and their supply chain need to pay more attention to GSCPs to mitigate their environmental effect. Green supply chain practices (GSCPs) include important measures such as green purchasing, total quality management (TQM) and environmental management systems (EMSs) (Zhu, Sarkis and Hung, 2008). Based on the previous research, these dimensions are operationalised as reflective (Zhu, Sarkis and Hung, 2008). The other reason for selecting the reflective mode is that both Total quality management systems (TQM) and Environment management system (EMS) emphasise common foundations based on Deming's quality principles, namely, continuous improvement; process improvement; management commitment; and optimisation, all of which can reduce waste (Rebelo, Santos and Silva, 2014). Hence,

the implementation of both systems has become a priority for organisations as they seek to achieve success in developing environmental practices and even work towards their own survival. In addition, green purchasing fundamentally integrates and incorporates environmental standards, thus providing appropriate responses to pressures from various stakeholders to follow green purchasing (Handfield et al., 2002). These dimensions covary with each other; thus, they are operationalised in the reflective mode, based on Jarvis et al's (2003) decision rules.

Simply stated, GSCPs are implemented effectively through external determinants: buyer participation, supplier cooperation and government support. For example, one important external determinant, as previously mentioned, is the government which has a major role in developing GSCPs (Zhu, Sarkis and Lai, 2013; Wu, Ding and Chen, 2012). The government can assist the company by providing sufficient information, financial assistance and various kinds of support to successfully run and develop GSCPs (Lee, 2008; Lin and Ho, 2011). In other words, governments can assist organisations to develop technical innovation through providing a variety of support and preparing correct information (Lin and Ho, 2011). For example, Ali et al. (2017) emphasised the critical impact of incentives, finding that these were offered by government to companies as an effective external factor to support them in developing GSCPs, such as green purchasing and eco-design.

The other important external factor in developing GSCPs is the influential role of buyer participation which significantly impacts on GSCP development in firms/supply chains (Laari et al., 2016; Lee, 2008). It is acknowledged that buyer participation and buyers' environmental demands significantly improve GSCPs through actions such as requesting environmentally friendly products; support for environmentally friendly packaging; and cooperation in decreasing energy consumption (Thun and Muller, 2010; Wu, Ding and Chen, 2012). For example, buyers, through their participation and environmental demands, require organisations to be aware of their green purchasing, thus motivating organisations to be involved in establishing quality systems and environmental standards (Chen, 2005). Another important external determinant highlighted by the literature is supplier participation in developing

GSCPs (Lee, 2008; Vachon and Klassen, 2006). For example, a close relationship with suppliers and effective management of suppliers can improve the adoption of GSCPs (Vachon and Klassen, 2006; Chiou et al., 2011). Activities, such as offering technical assistance, inviting suppliers for site visits and visiting suppliers' sites, can assist and encourage suppliers to become more 'green', thus supporting the development of green purchasing and meeting environmental standards (Chiou et al., 2011; Vachon and Klassen, 2006).

Therefore, external determinants (EXDETs) have a significant impact on green supply chain practices (GSCPs) (Tachizawa Gimenez and Sierra, 2015; Ahmed and Najmi 2018). Most previous research and studies have focused on the "direct and positive" impact of EXDETs on GSCPs which means that positive changes in EXDETs produce improvement and positive changes in GSCPs (Chiou et al., 2011; Lee, 2008; Mohanty and Prakash, 2014; Lo and Shiah, 2016).

Therefore, based on the above studies and theory, the hypothesis related to EXDETs and GSCPs is proposed as follows:

H1: External determinants (EXDETs) have a direct and positive influence on green supply chain practices (GSCPs) in the Australian food industry.

4.2.2 H2: Hypothesis of internal supply determinants to green supply chain practices

The previous section presented in detail the constructs for EXDETs and their relationship to GSCPs, with the constructs for internal supply determinants (INTDs) and their relationship to GSCPs discussed in the current section. Based on the literature, INTDs consist of important components including internal supply relationships (Hoejmose, Brammer and Millington, 2012; Sharfman, Shaft and Anex, 2009; Hassan et al., 2016) and agility (Jain and Gupta, 2016; Azevedo, Carvalho and Machado, 2016; Carvalho et al., 2016; Mirghafoori et al, 2017).

The construct 'internal supply determinants (INTDs)' was considered to be reflective due to the relationship between internal supply relationships and agility. For example, to be agile, it is necessary to have good relationships in the supply chain in terms of trust, collaboration and high commitment (Agarwal, Shankar and Tiwari, 2007; Narayanan, Narasimhan and Schoenherr, 2015). Therefore, the construct (INTDs)' was operationalised in the reflective mode, based on Jarvis et al's (2003) decision rules.

Internal supply determinants (INTDs) have a significant role in GSCP development. For example, Mirghafoori, Andalib and Keshavarz (2017) indicated that, in GSCP development, agility combines with various capabilities, such as quick responses to changes and flexibility in environmental product development. In a similar vein, Lakshmi and Visalakshmi (2012), in their study about the relationship between GSCPs and agility, emphasised the influential role of the agility capability in developing innovation in the supply chain, in ways such as green purchasing development. Internal supply relationships are the other important internal supply determinant factor in GSCP development. For example, referring to Hassan et al. (2016); Chin, Tat and Sulaiman (2015), in terms of trust and commitment, internal supply relationships are the prerequisites for improving green supply chain practices (GSCP). Simply stated, establishing proper relationships and integration with suppliers through trust, commitment and cooperation can develop company purchasing functions that produce environmentally friendly products and designs for recycling (Sharfman, Shaft and Anex, 2009).

The relationships between INTDs and GSCPs can be justified through the lens of the resource-based view (RBV). As explained in Chapter 2, Section 2.9, the resource-based view (RBV) was introduced in this study as an appropriate theory for justifying the importance of intangible and internal resources (Barney, 1991). The term "intangible resources" in RBV theory emphasises the firm's internal strengths, such as managerial capabilities, organisational culture and the relationships that develop firm competitiveness (Barney, 1991; Lynch, Keller and Ozanne, 2000). Therefore, in this study, INTDs, namely, agility and internal relationships, are justified through RBV

theory as effective factors in developing green supply chain practices (GSCPs). Furthermore, RBV theory has been extensively applied by logistics, supply chain management (SCM) and GSCM research (Bowersox, Closs and Stank, 1999; Lynch, Keller and Ozment, 2000; Shang, Lu and Li, 2010; Sarkis, Zhu and Lai, 2011; Liu et al., 2018).

According to the literature and resource-based view theory, INTDs can develop GSCPs (Mirghafoori, Andalib and Keshavarz, 2017; Sharfman, Shaft and Anex, 2009; Hassan et al., 2016). Hence, it can be concluded that INTDs have a significant impact on green supply chain practices (GSCPs). This means that any kind of change in INTDs results in GSCP changes (Lakshmi and Visalakshmi, 2012; Jain and Gupta, 2016; Hassan et al., 2016).

Therefore, following this discussion and the above theory, the hypothesis related to INTDs and GSCPs is proposed as follows:

H2: Internal supply determinants (INTDs) have a direct and positive influence on green supply chain practices (GSCPs) in the Australian food industry.

4.2.3 H3: Hypothesis of external determinants to internal supply determinants

External determinant constructs and internal supply determinant constructs were described in detail in the previous sections. In the current section, the relationship between external determinants (EXDETs) and internal supply determinants (INTDs) is discussed. As mentioned previously (in Chapter 2), only a few studies have been conducted on the impact of external determinants (EXDETs) on internal supply determinants (INTDs). The relationships between EXDETs and INTDs are justified through the lens of institutional theory (DiMaggio and Powell, 1983). Simply stated, EXDETs play an effective role in developing internal capabilities (Holt and Ghobadian, 2009). For example, referring to Geffen and Rothenberg (2000), government support can assist companies to be agile. However, the demand has been expressed for more scholars to investigate this relationship in detail (Green et al., 2012).

In addition, suppliers are the other important external determinant (EXDET) for developing internal supply determinants (INTDs). Selecting suitable suppliers and establishing an appropriate relationship with them can develop relational norms such as mutual trust, commitment and cooperation in the supply chain (Sharfman, Shaft and Anex, 2009; Hassan et al., 2016). This was supported by other researchers (Hoyt and Huq, 2000) who indicated that selecting an appropriate supplier and having a suitable relationship with them can develop trustful relationships, cooperation and collaboration between supply chain partners to increase the supply chain's flexibility and responsiveness.

Hence, based on the previous literature and theory justification it can be concluded that EXDETs have a significant positive impact on internal supply determinants (INTDs). Any change in EXDETs results in changes being made in internal supply determinants (INTDs) (Holt and Ghobadian, 2009). In the literature, these discussions have concentrated on the "direct and positive" impact of EXDETs on INTDs which shows that positive changes in EXDETs caused improvement and positive changes in internal supply determinants (INTDs). Hence, the following hypothesis is suggested for this relationship:

H3: External determinants (EXDETs) have a direct and positive influence on internal supply determinants (INTDs) in the Australian food industry

4.2.4 H4: Hypothesis of mediation role of internal supply determinants between external determinants and green supply chain practices

The literature does not clearly describe the mediatory role of internal supply determinants (INTDs) between GSCPs and external determinants (EXDETs). In the current study, however, based on logical assumptions from the previous literature (e.g., Geffen and Rothenberg, 2000), the mediatory relationships between these determinants were hypothesised. As discussed in Section 4.2.1, external determinants (EXDETs), namely, the government, suppliers and buyers are effective in GSCP development, with this justified through the lens of institutional theory (refer

to DiMaggio and Powell, 1983). As discussed in Section 4.2.2, based on resource-based view (RBV) theory, internal intangible resources are strong capabilities for firms in developing their practices and performance (refer to Barney, 1991). However, considering these two groups of determinants and theories separately is not sufficient, due to the importance of understanding the mediatory role of internal supply determinants (INTDs) between EXDETs and GSCPs in developing green supply chain practices (GSCP**s).**

Simply stated, it is essential to notice the interdependency between EXDETs and INTDs in developing GSCPs, with this justified through resource dependence theory (RDT) (Cheon et al., 1995). Based on RDT, firms interact with the external environment which requires them to adapt to environmental uncertainty and actively manage their resources (Pfeffer and Salancik, 1978). The RDT provides an interesting insight into understanding the mediatory role of INTDs between EXDETs and green supply chain practices (GSCPs). For example, the selection of appropriate suppliers can impact on internal supply relationships (IRs) by improving trust and effective cooperation for developing GSCPs, such as green purchasing. Based on the above-mentioned discussion and theories, it is understood that EXDETs can support the development of GSCPs through their interdependency with internal supply determinants (INTDs). With this backdrop, it can be hypothesised that:

H4: Internal supply determinants (INTDs) mediate the relationship between external determinants (EXDETs) and green supply chain practices (GSCPs) in the Australian food industry

4.2.5 H5: Hypothesis of green supply chain practices to firm performance

In the previous section (Section 4.2.1), the construct 'green supply chain practices (GSCPs)' was discussed in detail. The current section concentrates on the construct 'firm performance' and its relationship with green supply chain practices (GSCPs). Green supply chain management (GSCM) is known as an innovative and unique resource for firms when developing their performance through GSCPs, such as total quality management (TQM), environmental management systems (EMSs) and green

purchasing (Zhu et al., 2008). Successful implementation of these practices is supported by firms' internal strengths in terms of managerial capabilities, organisational culture and appropriate relationships, with this justified through the resource-based view (RBV) theory (refer to Barney, 1991).The firm performance construct (PE) comprises three significant components, namely, environmental performance, economic performance and operational performance (Mirghafoori, Andalib and Keshavarz, 2017; Zhu, Sarkis and Lai, 2013; Laari et al., 2016).

It has been acknowledged that considering GSCPs for minimising environmental issues leads organisations and their supply chains to achieve improved performance (Tippayawong Tiwaratreewitb and Sopadanga, 2015; Lee, Kim and Choi, 2012; Chiou et al., 2011). Much of the literature has emphasised the variety and significance of GSCPs which can develop different aspects of firm performance:

- One of the important aspects in implementing GSCPs to develop firm performance is related to green purchasing (Laosirihongthong et al., 2013; Lee et al., 2012; Hassan et al., 2016; Zhu et al., 2008). Referring to Laosirihongthong Adebanjo and Tan (2013), green purchasing capabilities that develop firm environmental performance include ensuring that suppliers meet environmental objectives; requiring suppliers to be EMS-certified; and auditing suppliers' environmental activities. In a similar vein, another study emphasised that green purchasing has a positive impact on economic performance due to the reduction in consumption of materials and energy (Younis, Sundarakani and Vel, 2016).
- Another important GSCP dimension for improving GSCPs and firm performance is total quality management (TQM), with this supported by the literature (Zhu and Sarkis, 2004; Sarkis et al., 2016). With the aim of eliminating waste, TQM is a critical management tool that can assist firms/supply chains to solve environmental issues and develop firm environmental performance (Corbett and Klassen, 2006; Sarkis et al., 2016).
- Another crucial GSCP dimension to improve firm performance is related to the establishment of an environmental management system (EMS) (Diabat and Govindan, 2011; Testa and Iraldo, 2010; Sharma, Chandana and Bhardwaj, 2015).

Due to its valuable benefits, the EMS is known to be an effective dimension for GSCPs for improving firm performance (Hillary, 2004; Zutshi and Sohal, 2004). For example, the numerous benefits derived from EMSs, such as assisting management to cultivate environmental awareness; increasing the motivation of personnel to preserve the environment; producing high-quality products; and achieving cost savings lead to improved firm environmental performance (Hillary, 2004; Massoud et al, 2010).

Overall, the above discussions and theory justification in previous studies have emphasised the "direct and positive" impact of GSCPs on firm performance, showing that positive changes in GSCPs lead to improvement and change in firm performance. It can therefore be concluded that GSCPs have a significant impact on firm performance. As a result, in the current study, understanding the relationship between GSCPs and firm performance is very important. Therefore, based on this information and in accordance to the earlier discussion, the hypothesis related to GSCPs and firm performance is proposed as follows:

***H5: Green supply chain practices (GSCPs) have a direct and positive influence on firm performance {PE) in the Australian food industry*.**

4.3 SUMMARY OF DEVELOPED HYPOTHESES

Based on the designed comprehensive model, five hypotheses describing five relationships have been developed. The comprehensive model, as shown in Figure 4.1 includes the determinants and variables derived from the extensive review of the previous literature. Table 4.1 presents all the hypotheses developed by the study as discussed above. These hypotheses are also shown in Figure 4.2.

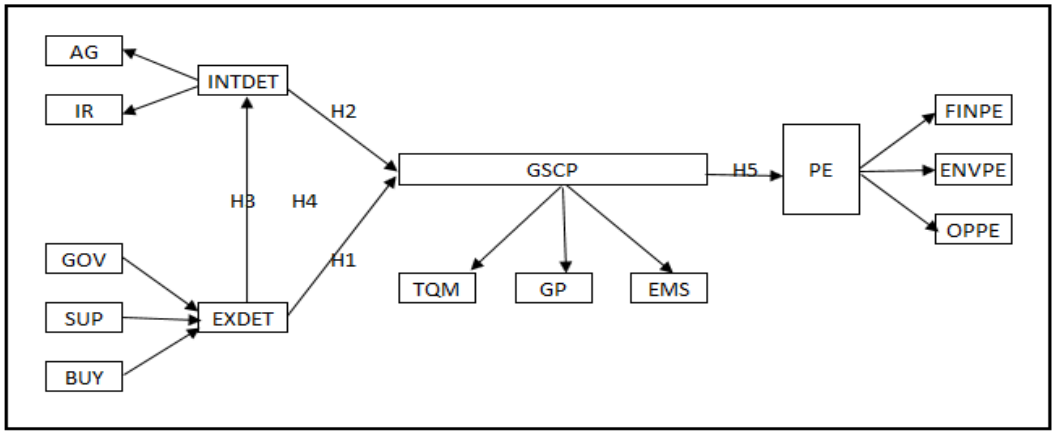

Figure 4.2: Research hypotheses

Table 4.1: Summary of hypotheses development

Link	H#	Hypothesis statement	References
EX DET → GSCP	H1	External determinants have a direct and positive impact on green supply chain practices	Lee (2008); Lin and Ho (2011); Hu and Hsu (2010); Zhu, Sarkis and Geng (2005)
INTD → GSCP	H2	Internal supply determinants have a direct and positive impact on green supply chain practices	Mirghafoori, Andalib and Keshavarz (2017); Lakshmi and Visalakshmi (2012); Hassan et al. (2016)
EXDET → INTD	H3	External determinants have a direct and positive impact on internal supply determinants	Sharfman, Shaft and Anex, 2009; Hassan et al. (2016)
EX DET → INTD → GSCP	H4	External determinants have an indirect and positive impact on green supply chain practices through internal supply determinants	Gefen, Straub, and Boudreau (2000)
GSCP → PE	H5	Green supply chain practices have a direct and positive impact on firm performance	Green et al. (2012); Chien and Shih (2007); Sarpong, Sarkis and Wang (2016)

4.4 QUESTIONNAIRE DEVELOPMENT FOR FINAL SURVEY

In this study, a questionnaire (see Appendix A) was designed to collect survey data. This questionnaire was developed based on the extensive review of relevant literature and theoretical support and was approved by the Curtin University Human Research Ethics Committee. In the following section, the questionnaire development is discussed in detail.

4.4.1 Overview of the questionnaire

In designing the questionnaire, much attention was paid in choosing appropriate research items. Several factors were considered for each construct with regard to increasing the reliability and validity of the measurement. In the first step, the extensive review of the previous literature led to identifying the right items for each construct in the research model. In the second step, the designed questionnaire was revised by the Australian food industry with an academic and a practitioner to ensure any required modification was identified and completed. Lastly, the final version of the questionnaire, designed for data collection and testing the research hypotheses, was proposed (Figure 4.2). The developed questionnaire was divided into sections. The first section of the questionnaire sought to obtain information about the demographic variables from the respondents. The second section included GSCP dimensions (green purchasing, TQM and EMSs). The third section encompassed external determinants (EXDETs), namely, the government, buyer cooperation and supplier participation, followed by internal supply determinants (INTDs) including agility and internal supply relationships in the fourth section. Finally, firm performance dimensions were included in the fifth section. In the questionnaire, a five-point Likert scale was used in line with previous literature (Zhu, Sarkis and Lai, 2008; Chavez et al., 2016 and Vanpoucke, Quintens and Van Engelshoven, 2016).

4.4.2 Measurement instrument development

As mentioned in the previous chapter, the questionnaire included 57 items in the measurement instrument, excluding the demographic questions. In this study both reflective and formative constructs were considered for SmartPLS analysis. However, in the research model all the first order measurement items operationalised were reflective based on the previous literature. The details of decision criteria for reflective measurement and formative measurement were discussed in detail in Chapter 3.

Questionnaire Section 1: Demographic variables

The aim of this section was to meticulously describe the demographic information of research respondents. The demographic questions sought details from each

respondent (education, length of employment in the firm, position) as well as details on their firm (size, number of employees, type of production and firm turnover). In this section, demographic variables were measured through using both open-ended and closed-ended questions. All seven questions in the demographic section used numeric scales. Moreover, in some demographic questions, respondents were provided with the opportunity to respond in open-ended places when one response was ‘’others”. For example, ‘positions at firm’ offered eight choices. Respondents were asked to complete the section “Others” if none of the provided choices related to their position in the firm. Table 4.2 presents the demographic variables.

Table 4.2: Question about demographic variables

Items	Variable	Measure
1	State/territory	Nominate the location of the firm
2	Turnover	Amount of annual revenue
3	Size	Define number of employees engaged in the food industry
4	Position	Nominate their position in the food industry
5	Experience	Nominate the number of years they’ve worked in the food industry
6	Education	Nominate your education level
7	Product type	Nominate the types of product produced by the firm

Questionnaire Section 2: Green supply chain practices

This section incorporated the measurement items with respect to green supply chain practices (GSCPs). The designed questions measured the direct impact of the GSCP construct on the development of firm performance. The higher-order construct ‘GSCPs’, based on the previous literature (Zhu, Sarkis and Lai, 2008), was measured by the dimensions: total quality management (TQM), environmental management systems (EMSs) and green purchasing. All three GSCP dimensions were measured by reflective factors as previous studies, for example, Zhu, Sarkis and Lai (2008), measured the GSCP construct, such as green purchasing, TQM and EMSs, in the reflective mode. Hence, in this study, TQM, green purchasing and EMS were

determined to be reflective. Overall, this section was divided into three subsections: 2-A, 2-B and 2-C.

Subsection 2-A comprised the measurement instrument for the construct 'green supply chain practices' with respect to the environmental management system and its factors, whereas 2-B was the measurement instrument for the construct 'green supply chain practices' with respect to total quality management and their factors, and 2-C was the measurement instrument for the construct 'green supply chain practices' with respect to green purchasing and their factors. Table 4.3 presents the measurement of green supply chain practices (GSCPs). For this part of the questionnaire, the five-point Likert scale was designed as: (1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; and 5 = strongly agree) and (1= Very little extent; 2= Little extent; 3= Some extent; 4= Great extent; 5= Very great extent)

Table 4.3: Measurement of green supply chain practices (GSCPs)

Green supply chain practices (GSCPs)	Dimensions		Statement	Sources
Environmental management system (EMS)	EMS Attitude	EMSAT1	To what extent does your firm pursue environmentally friendly practices?	Developed based on the literature review (Hillary, 2004 and Quazia et al., 2001)
		EMSAT2	To what extent are environmentally friendly practices highlighted in your firm vision?	Developed based on the literature review (Hillary, 2004)
		EMSAT3	To what extent is your firm interested in implementing environmentally friendly practices?	Developed based on the literature review (Hillary, 2004 and

Green supply chain practices (GSCPs)	Dimensions		Statement	Sources
				Quazia et al., 2001)
	EMS Constituents	EMSCO1	It needs a long time to get EMS certified	Hillary (2004)
		EMSCO2	EMS will help our firm gain a competitive advantage over our competitors	Hillary (2004)
		EMSCO3	EMS can assist top management to cultivate environmental awareness within the firm	Quazia et al. (2001)
		EMSCO4	The benefits of EMS outweigh the costs needed to implement the program in our organisation	Quazia et al. (2001)
	EMS Benefits	EMSBF1	Improvement of corporate image	Massoud et al. (2010); Zeng, Shi and Tian (2005)
		EMSBF2	Better relationship with stakeholders	Massoud et al. (2010); Zeng, Shi and Tian (2005)
		EMSBF3	Preserving the environment	Rao (2002)
		EMSBF4	Increasing personnel motivation	Hillary (2004)
		EMSBF5	Quality improvement	Hillary (2004)
		EMSBF6	Improving social commitment	Hillary (2004)
Green purchasing (GP)	GP1		Our firm uses environmental and technical standards for purchasing raw materials	Shekari et al (2011)
	GP2		Our firm provides design specification to suppliers	Zhu et al. (2008); Green et al. (2012)
	GP3		We require our supplier to have an approved certification	Zhu et al. (2008); Green et al. (2012)
	GP4		We collaborate with our suppliers for environmental objectives	Zhu et al. (2008);

Green supply chain practices (GSCPs)	Dimensions	Statement	Sources
			Green et al. (2012)
	GP5	We audit suppliers' internal operations	Zhu et al. (2008)
Total quality management (TQM)	TQM1	We have a strong commitment to environment protection at all levels of our organisation	Developed from Zeitz et al. (1997); Tan et al. (1999)
	TQM2	Continuous environmental improvement is an important factor in our company	Developed from Zeitz et al. (1997)
	TQM3	The supplies/ material that I received from the outside organisation meet my environmentally friendly goals	Developed from Zeitz et al. (1997)
	TQM4	We benchmark our environmental practice in our industry	Developed from Tan et al. (1999)
	TQM5	Our customers are highly important as a source of ideas for new products	Developed from Zeitz et al. (1997); Tan et al. (1999)

Questionnaire Section 2-A

Questionnaire Section 2-A included the measurement instrument for the construct "EMS" with respect to the constitution of organisational policy about using an environmental management system (EMS); organisational attitude towards the implementation of an EMS system; and the EMS's prospective benefits. ***The EMS construct, in both first-order constructs and their factors, was measured as reflective***. The reason was that, for example, designing environmental policy in a company is strongly dependent on the organisational attitude towards an EMS and its potential benefits. Therefore, referring to Jarvis et al. (2003), these factors covary each other and is considered to be reflective. The questions in this section were divided into three groups: 2-A-1; 2-A-2; and 2-A-3 as described below:

- Questions in group 2-A-1 sought to understand the organisational attitude toward the EMS's implementation. All the items (EMSAT1 to EMSAT3) were adopted based on previous studies (Hillary, 2004; Quazia et al., 2001) and ranged across: 'to what extent does your firm pursue environmentally friendly practices?', 'to what extent are environmentally friendly practices highlighted in your' and 'to what extent is your firm interested in implementing environmentally friendly practices?'. These three questions about the organisational attitude toward the EMS's implementation are all interrelated and mutually supportive. For example, when an organisation considers implementation of an EMS in its vision, this means that it is interested in this environmental philosophy. ***Therefore, referring to Jarvis et al. (2003), these factors covary each other and the first-order construct, attitude toward an EMS, is considered to be reflective***.
- Questions in group 2-A-2 referred to the environmental management system (EMS) policy constituents. All the items (EMSCO1 to EMSCO3) were developed by the researcher based on the extensive literature review on quality and addressed the following points: 'takes a long time to be EMS-certified'; 'an EMS will help our firm to gain a competitive advantage over our competitors'; 'an EMS can assist top management to cultivate environmental awareness within the firm' and 'the benefits of EMS outweigh the costs needed to implement the program in our organisation'. These policy constituent factors all are interrelated. For instance, cost advantage and competitive advantage are interrelated***. Hence, referring again to Jarvis et al. (2003), these factors covary each other and this first-order construct is considered to be reflective***.
- Questions in group 2-A-3 sought to discover the EMS benefits for firms. All the items (EMSBF1 to EMSBF6) were selected from earlier studies (Hillary, 2004; Massoud et al., 2010; Zeng, Shi and Tian, 2005). Items focused on: 'improvement of corporate image'; 'better relationship with stakeholders'; 'preserving the environment'; 'increasing motivation of personnel'; 'quality improvement'; and 'improving social commitment'. Table 4.3 presents the measurement items and the related statements corresponding to each EMS dimension. The EMS benefit factors are all interrelated. For instance, 'quality improvement' is directly related

to the factors 'improving social commitment' and 'improvement of corporate image'. ***Hence, referring to Jarvis et al. (2003), these factors covary each other and this first-order construct is considered to be reflective.***

- ***Questionnaire Section 2-B***

Questionnaire Section 2-B included the measurement instrument for the construct "TQM" with respect to quality principles. This factor was measured by the items TQM1 to TQM5: 'strong commitment to environmental protection'; 'continuous environmental improvement'; 'providing environmentally friendly materials from outside organisation'; 'benchmarking'; and 'a customer focus', with these derived from the previous literature (Zeitz et al., 1997; Tan et al., 1999). ***Also, based on the previous studies, TQM principles, such as management commitment, customer focus and supplier relationships (regarding materials preparation), were operationalised as reflective*** (Agus, Krishnan and Kadir, 2000). In Table 4.3, the measurement items and related statements corresponding to each TQM dimension are presented.

Questionnaire Section 2-C

This section included the measurement instrument for the construct "green purchasing" (GP) with respect to purchasing based on environmentally friendly functions. Green purchasing was measured by the items GP1 to GP5: 'our firm uses environmental and technical standards for purchasing raw materials'; 'our firm provides design specifications to suppliers'; 'we require our suppliers to have approved certification'; 'we collaborate with our suppliers on environmental objectives'; and 'we audit suppliers' internal operations' (Zhu, Sarkis and Lai, 2008; Green et al., 2012). The above-mentioned green purchasing factors are strongly interrelated in developing GSCM practices and appear to covary due to their interdependence. ***Therefore, referring to Jarvis et al. (2003), the construct green purchasing (GP) is considered to be reflective***. Table 4.3 shows the measurement items and related statements corresponding to each green purchasing dimension.

Questionnaire Section 3: External determinant factors

The purpose of the second section of the questionnaire was to identify and measure the influence of external determinant (EXDET) factors on green supply chain practices (GSCPs) as well as on internal supply determinants (INTDs). For this study, all the EXDET subfactors were adopted from previous studies. Referring to Holt and Ghobadian (2009); Ali et al. (2017); and Zhu, Sarkis and Lai (2013), the main subfactors of EXDETs measured in this section were: the government, suppliers and buyers. ***The construct 'external determinants (EXDETs)' was operationalised as formative as the items caused the latent variable and the items were defining characteristics of the construct (Jarvis et al., 2003*****). In addition, it was assumed that the dimensions (suppliers, buyers and the government) were not correlated; they were also not interchangeable (Jarvis et al., 2003).***

This section was divided into three subsections: 3-A, 3-B and 3C. Subsection 3-A comprised the measurement instrument for the construct 'external determinants' with respect to the government and its factors, whereas 3-B was the measurement instrument for the construct 'external determinants' with respect to suppliers and their factors, and 3-C was the measurement instrument for the construct 'external determinants' with respect to buyers and their factors. Each of these subfactors had several dimensions which are presented in Table 4.4. For this part of the questionnaire, the five-point Likert scale was designed as: 1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; and 5 = strongly agree.

Table 4.4: Measurement of external determinants

External determinants	Item	Statement	Sources
	SUP1	We invite suppliers' personnel to our site to increase their awareness	Vachon and Klassen (2009); Chiou et al. (2011)

External determinants	Item	Statement	Sources
Suppliers (SUP)	SUP2	We select our suppliers based on their environmental competencies	Paulraj (2009)
	SUP3	Our firm requires suppliers to use environmentally friendly packaging (e.g., degradable and non-hazardous material)	Zhu, Sarkis and Lai (2007) Chiou et al. (2011)
	SUP4	We offer technical assistance to our suppliers	Large and Thomsen (2011); Chiou et al. (2011)
	SUP5	We make site visits to suppliers to help them to improve their performance	Large and Thomsen (2011)
Government (GOV)	GOV1	Increasing support from government	Massoud et al. (2010)
	GOV2	Appropriate source of finance	Zailani et al. (2012)
	GOV3	sufficient information on technology	Massoud et al. (2010)
Buyers (BUY)	BUY1	Our firm cooperates with customers to get their request about producing special products	Green et al. (2012); Zhu, Sarkis and Geng (2005); Zhu, Sarkis and Lai (2012)
	BUY2	We meet our customers' needs on a regular basis to find out what products they will need in future	Developed from Zhu and Saris (2006)
	BUY3	Our firm cooperates with customers for environmentally friendly packaging	Zhu, Sarkis and Lai (2008); Green et al. (2012); Zhu, Sarkis and Geng (2005); Zhu, Sarkis and Lai (2012)
	BUY4	Our firm cooperates with customers for using less energy during product transportation	Zhu, Sarkis and Lai (2008); Green et al. (2012); Zhu, Sarkis and Lai (2012)

Questionnaire Section 3-A

The government is a significant external determinant through its supportive role in GSCP development (Benito J. and Benito, O., 2006; Nezakati, Fereidouni and Rahman, 2016) and with internal supply determinants (INTDs). This dimension was measured by the factors, GOV1 to GOV3, which were: 'increasing support from government'; 'appropriate source of finance'; and 'sufficient information on technology', referring to the previous literature (Zailani et al., 2012; Massoud et al., 2010). ***The factors under the government dimension were operationalised in the reflective mode following Jarvis et al.'s (2003) decision rules. The reason was that the government factors were manifestations of the construct and were expected to covary with each other***. Moreover, previous studies have also supported reflective constructs for government factors (Massoud et al., 2010). Table 4.4 presents the government factors.

Questionnaire Section 3-B

A critical external determinant in developing GSCPs and internal supply determinants (INTDs) is the selection of suitable suppliers and the establishment of an appropriate relationship is that establishing a proper relationship with suppliers can develop the organisational ability and flexibility to respond appropriately to uncertainty (Narasimhan and Das, 1999).

This dimension was measured by the factors (SUP1 to SUP5) which were: 'inviting suppliers' personnel to the site to increase their awareness'; 'selecting our suppliers based on their environmental competencies'; 'requiring suppliers to use environmentally friendly packaging (e.g., degradable and non-hazardous materials)'; 'we offer technical assistance to our suppliers'; and 'we make site visits to suppliers to help them to improve their performance', with these measures supported by the previous literature (Klassen and Vachon, 2003; Rao, 2005). ***The suppliers' dimension was measured by reflective factors as they are manifestations of the construct and are expected to covary with each other (Jarvis et al., 2003).*** Moreover, the items were assumed to be correlated and were interchangeable (Jarvis et al., 2003). For example, suppliers' factors such as inviting suppliers' personnel to the firm's site;

making site visits to suppliers' sites; and cooperating with suppliers and offering technical assistance to them, are all related to each other. Table 4.4 presents the supplier factors.

Questionnaire Section 3-C

Buyers' participation is a strong weapon to encourage supply chain partners to participate in GSCPs (Lee and Klassen, 2008). Buyers' environmental requirements encourage firms to be flexible and agile in developing environmental practices (Carvahelo et al., 2016). This dimension was measured by the factors, BUY1 to BUY4, which were: 'cooperating with buyers to obtain their requests about producing special products'; 'meeting buyers' needs on a regular basis to find out what products they will need in future'; 'cooperating with buyers on environmentally friendly packaging'; and 'cooperating with buyers by using less energy during product transportation', with these contextualised from the previous literature (Green et al., 2012; Zhu, Sarkis and Geng, 2005; Zhu, Sarkis and Lai, 2012). ***The buyers' dimension was measured by reflective factors as they are manifestations of the construct and are expected to covary with each other, following the decision rules of Jarvis et al. (2003).*** For example, buyers' factors, such as cooperating with buyers to obtain their requests about producing special products and meeting buyers' needs on a regular basis, are related to each other. Table 4.4 presents details of the measurement of buyers' (external) determinants.

Questionnaire Section 4: Measurement of internal supply determinants

The objective of this section of the questionnaire was to measure internal supply determinants (INTDs). The designed questions measured the direct impact of the INTDs construct on GSCP development. The questions also measured the mediation role of INTDs between external determinants (EXDETs) and green supply chain practices (GSCPs). ***In this study, the construct, INTDs, was measured by reflective factors: agility (AG) and internal supply relationships (IRs) as the indicators were manifestations of the construct and were expected to covary with each other, following the decision rules of Jarvis et al. (2003).*** Simply stated, agility needs strong internal supply relationships (IRs) to be able to appropriately respond to change.

The higher-order construct 'internal supply determinants (INTDs)' was measured by the dimensions, agility and internal supply relationships (IRs), and was divided into two subsections, 4-A and 4-B. Section 4-A comprised the measurement instrument for the construct 'agility' while Section 4-B was the measurement instrument for the construct 'internal supply relationships (IRs)'. For this part of the questionnaire, the five-point Likert scale was designed as: 1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; and 5 = strongly agree. Table 4.5 presents details of the measurement of internal supply determinants.

Table 4.5: Measurement of internal supply determinants

Internal supply determinants	Item	Statement	Sources
Agility (AG)	AG1	We can quickly accommodate requests for changes	Mirghafoori et al. (2017); Fernando and Saththasivam (2017)
	AG2	We are flexible in managing our relationship with suppliers	Mirghafoori et al. (2017)
	AG3	Our firm has the technical competence to develop environmentally friendly practice	Fernando and Saththasivam (2017)
	AG4	In our partnership, we and our partner expect to be able to make adjustments in our relationship to cope with changing circumstances	Sharifi and Zhang (2000)
Internal supply relationships (IRs)	IR1	The extend of mutual trust and respect with suppliers	Ganesan (1994); Morgan and Hunt (1994)
	IR2	The extent of willingness to stay within the terms of the contract with our supplier (commitment)	Developed from Ford (1980)
	IR3	The extent of capabilities to help one another regarding improving environmentally friendly practices	Developed from Ganesan (1994); Morgan and Hunt (1994)
	IR4	The extent of communications between our firm and our suppliers about environmentally friendly practices	Anderson and Narus (1990, p. 44)

	IR5	The extent of continually evaluating and improving the environmentally friendly products/services to meet our buyer requirement	Developed from Paulraj (2009) and Zhu et al. (2007)
	IR6	The extent of involving suppliers to environmentally friendly decision making	Morgan and Hunt (1994)

Questionnaire Section 4-A

The construct 'agility (AG)' reflects the ability of the organisation/supply chain to quickly respond to market needs (Zhang and Sharifi, 2000). This factor was measured by the items AG1 to AG4 which were: 'quickly accommodate requests for changes' (Fernando and Saththasivam, 2017); 'flexible in managing our relationship' (Mirghafoori et al., 2017); 'technical competence to develop environmentally friendly practices' (Fernando and Saththasivam (2017); and, finally, the item 'we and our partners expect to be able to adjust our relationship to cope with changing circumstances' (Sharifi and Zhang, 2000). ***Also, agility factors were operationalised as reflective as the previous literature supported reflective measurement*** (Mirghafoori et al., 2017; Fernando and Saththasivam, 2017). Table 4.5 presents the agility measurements in detail.

Questionnaire Section 4-B

The construct 'internal supply relationships (IRs)' reflects the ability of a supply chain to find trustworthy relationships with suppliers for GSCP development (Hoejmose, Brammer and Millington, 2012; Sharfman, Shaft and Anex, 2009). Trustworthy relationships in supply chains can develop resources by exchanging and achieving appropriate information and facilities (Dangelico and Pujari, 2010; Pujari, 2006; Kulangara, Jackson and Prater, 2016; Khan et al., 2018). Internal supply relationships (IRs) were measured by the items IR1 to IR6 and were: 'the extent of mutual trust in and respect for suppliers'; 'the extent of willingness to stay within the terms of contracts with suppliers'; 'the extent of capabilities to help one another regarding improving environmentally friendly practices'; 'the extent of communications between the firm and its suppliers about environmentally friendly practices'; 'the extent of continual evaluation and improvement of environmentally friendly

products/services to meet our buyers' requirements'; and 'the extent of involving suppliers to environmentally friendly decision making'. ***Also, internal supply relationship (IR) factors were operationalised in reflective mode as the internal supply relationship (IR) indicators appeared to covary with each other due to their interdependence (Jarvis et al., 2003).*** For example, good communication between supply chain partners can develop the capability to help each other and develop cooperation. Table 4.5 presents details of the measurement of internal supply relationships (IRs).

Questionnaire Section 5: Firm performance

This section incorporated the measurement items with respect to firm performance. The designed questions measured the direct impacts of the construct 'green supply chain practices (GSCPs)' on the development of firm performance. The second-order construct 'firm performance', based on the previous literature (Longoni and Cagliano, 2018; Zhu, Feng and Choi, 2015; Zhu, Sarkis and Lai, 2008; Green et al., 2012), was measured by the following dimensions: operational, financial and environmental performance. ***The construct 'firm performance' was considered as reflective in both second- and first-order constructs as previous studies, for example, Chien and Shih (2007); and Rao (2002), considered the environmental, operational and economic performance measurement in the reflective mode.*** The five-point Likert scale, namely, as: 1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; and 5 = strongly agree, was employed for this section.

Environmental performance was emphasised in the organisation's consideration of reducing its environmental impact and meeting the environmental sustainability requirements of its supply chain. Environmental performance measures were selected from Green et al. (2012); Zhu, Sarkis and Geng (2005); and Zhu, Sarkis and Lai (2012) as well as the items suggested by Laosirihongthong, Adebanjo and Tan (2013) and Diabat and Govindan (2011). The factors ENVPE1 to ENVPE4 which related to 'reduced emissions into the air', 'reduced consumption of water', 'reduction of waste' and 'reduced energy use' were finally chosen to measure environmental performance based on the previous literature.

Economic performance is related to the financial strength of the organisation to preserve its business profitability. Economic performance was measured by the items FINPE1 to FINPE4 which were: 'waste discharge'; 'waste treatment'; 'reduction in fines'; and 'high operational cost', with reference to previous studies (Zhu, Sarkis and Lai, 2008; Green et al., 2012; Zhu, Sarkis and Geng, 2005). Operational performance referred to the diverse range of operations that: 'producing high quality product'; 'producing the variety of product lines'; 'on-time delivery'; and 'lower inventory levels. The items (OPPE1 to OPPE4) for operational performance were considered from the previous literature (Zhu, Sarkis and Lai, 2008; Green et al., 2012; Rao, 2002). The items related to the operational, environmental and financial performance of GSCPs are presented in Table 4.6.

Table 4.6: Measurement of firm performance

Performance	Item	Statement	Sources
Operational performance (OPPE)	OPPE1	Our production process produces high-quality product	Zhu, Sarkis and Lai (2008); Green et al. (2012); Rao (2002)
	OPPE2	Our production process can produce a variety product lines	Zhu, Sarkis and Lai (2008; Green et al. (2012); Zhu, Sarkis and Geng (2005)
	OPPE3	Our production process delivers goods on time	Zhu, Sarkis and Geng (2005); Zhu, Sarkis and Lai (2012)
	OPPE4	Our production process has lower inventory levels	Zhu, Sarkis and Lai (2008); Green et al. (2012); Zhu, Sarkis and Geng (2005)
Environmental performance (ENVPE)	ENVPE1	Our production process produces less emissions into the air	Zhu, Sarkis and Lai (2008); Green et al. (2012); Zhu, Sarkis and Geng (2005); Zhu, Sarkis and Lai (2012)
	ENVPE2	Our production process consumes less water	Zhu et al. (2005); Zhu et al. (2012)
	ENVPE3	Our production process produces less solid wastes	Zhu, Sarkis and Geng (2005); Green et al. (2012); Rao (2002); Zhu, Sarkis and Lai (2012)

	ENVPE4	Our production process results in less energy consumption	Laosirihongthong, Adebanj and Tan. (2013); Diabat and Govindan (2011)
Financial performance (FINPE)	FINPE1	Our production process results in lower fees for waste discharge	Zhu, Sarkis and Lai (2008); Green et al. (2012); Zhu, Sarkis and Geng (2005)
	FINPE2	Our production process results in lower fees for waste treatment	Zhu, Sarkis and Lai (2008); Green et al. (2012); Zhu, Sarkis and Geng (2005)
	FINPE3	Our production process results in a reduction in fines for environmental accidents	Zhu, Sarkis and Lai (2008); Green et al. (2012); Zhu, Sarkis and Geng (2005))
	FINPE4	Our production process has high operational cost	Zhu, Sarkis and Geng (2005)

4.5 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) BENEFITS AND BARRIERS

This section of the questionnaire was related to two groups of firms: those in the process of implementing an EMS and those that were not interested in EMS implementation. For firms in the process of implementing an EMS, respondents were asked about the benefits achieved from EMS implementation. Respondents from firms that were not interested in EMS implementation were asked about the barriers to EMS implementation. The two groups of answers to these questions were not analysed through SmartPLS. However, SPSS was used to analyse these two groups of data. The benefits of implementing an EMS are presented in Table 4.7 while, in Table 4.8, the barriers to EMS implementation are listed.

Table 4.7: Benefits of implementing an EMS

Factors	Item	Sources
Preserving the environment	BF1	Developed from De Oliveira, Serra and Salgado (2010)
Clean operations	BF2	Massoud et al. (2010)
Improving social commitment	BF3	Rao (2002)
An EMS can assist top management to cultivate environmental awareness within the firm	BF4	Developed from Liyin, Hong and Griffith (2006)
Recycling	BF5	MCKeiver and Gadenne (2005); Testa and Iraldo (2010)
Improvement of corporate image	BF6	Massoud et al. (2010); Zeng, Shi and Tian (2005)
Reduction of solid/liquid waste	BF7	Pena, Garrido and Lopez (2014); Shi et al (2012); Zhu and Sarkis (2004)
Reduction of emissions	BF8	Pena, Garrido and Lopez (2014); Shi et al (2012)
Quality improvement	BF9	Hillary (2004); Mahmood, Rahman and Deros (2011)
Better relationship with stakeholders	BF10	Hillary (2004)
Increasing opportunities to create competitive advantages	BF11	Zhu and Sarkis (2006) Lamming and Hampson (1996)
Provides evidence of legal compliance	BF12	Beamon (1999) Min and Galle (2001)
Cost saving	BF13	Pena, Garrido and Lopez (2014)
The benefits of EMS outweigh the costs	BF14	Quazia et al. (2001)
Increasing support from government	BF15	Massoud et al. (2010)
New market opportunities	BF16	Rao (2002); Salomone (2008)
Improving sales	BF17	Rao (2002)
Increasing motivation of personnel n	BF18	Hillary, 2004 and Massoud et al, 2010
An EMS will help our firm to gain a competitive advantage over our competitors.	BF19	Pena, Garrido and Lopez (2014)
Gaining new customers	BF20	Wycherley (1999); Walker Sisto and McBain (2008)
Improving profit margin	BF21	Rao (2002)
Improving market share	BF22	Rao (2002)

Table 4.8: Barriers to implementing an EMS

Factors	Item	Sources
Other priorities/investments were more important	BAR1	Rohdin and Thollander (2006); Seiffert (2008)
Current product meets customer requirements	BAR2	Massoud et al (2010)
Insufficient drivers or incentives	BAR3	Chan (2008); Gunningham (2007)
Lack of financial resources	BAR4	Chan (2008)
Lack of government support	BAR5	Massoud et al (2010) Govindan et al (2014)

Lack of training	BAR6	Hillary (2004); Bowe et al (2001)
Low awareness of environmental legislation	BAR7	Developed from Aslam et al (2018); Diabat and Govinda (2011)
High cost	BAR8	Pena, Garrido and Lopez (2014) Chan (2008)
Lack of management commitment	BAR9	Pena, Garrido and Lopez (2014) Chan (2008)
Insufficient technical expertise	BAR10	Hillary (2004)
It takes a long time to be EMS-certified	BAR11	Govindan et al (2014)
Lack of firm's environmental standards	BAR12	Govindan et al (2014) Rao and Holt (2005)
Reduced return-on-investments	BAR13	Govindan et al (2014)
Lack of supplier commitment	BAR14	Govindan et al (2014); Walker, Di Sisto and McBain (2008)
Lack of customer awareness	BAR15	Govindan et al (2014); Walker, Di Sisto and McBain (2008)
Lack of new technology	BAR16	Govindan et al (2014)
Implementing an EMS needs high investment	BAR17	Govindan et al (2014)
Complexity in design to recycle the product	BAR18	Hillary (2004)
Size of firm's operation is too small	BAR19	Hillary (2004)
Organisational resistance	BAR20	Walker, Di Sisto and McBain (2008); Hillary (2004)
Fear of failure in environmentally friendly project	BAR21	Govindan et al (2014)
Disbelief about the environmental benefits	BAR22	Govindan et al (2014)

4.6 REFINEMENT PROCEDURE

The initial questionnaire was modified firstly by sending it to five practitioners and an academic expert comprising:

- two food and agribusiness academics in Australia;
- one agri-food/agribusiness specialist in market analysis, strategy and policy in Australia;
- one Food and AgriBusiness Manager at National Australia Group; and
- One Food Safety Auditor at SGS (Société Générale de Surveillance) Australia

The researcher contacted these respondents over LinkedIn and then either placed the questionnaire link on LinkedIn for them or sent the questionnaire by email. They were requested to review and comment on the selected items for each determinant.

This process was to determine if the survey instrument (the questionnaire) might need revising to provide appropriate content, wording and layout and to ensure it could be understood even if completion was rapid. Respondents' opinions indicated that some statements in the questionnaire needed additional clarification for be better understood. For example, one respondent requested more explanation about the term 'green purchasing'. Another respondent requested separate section for the three groups of respondents: those from EMS-certified firms, those from firms without an EMS, and those from firms in the process of implementing an EMS. The final designed questionnaire incorporated all the practitioners' suggestions (see questionnaire in Appendix). The final version of the questionnaire was then organised for broader distribution to firms in the Australian food industry

4.7 SUMMARY

In this chapter, the hypotheses based on the comprehensive research model were developed and presented. The measurement items were selected based on the extensive literature review. The justification of each developed hypothesis was also discussed based on the extensive review of the literature on green supply chain practices (GSCPs). Overall, five hypotheses were presented to describe the relationships between the research constructs in the comprehensive model. The development of the measurement items for the survey questionnaire was then presented. Excluding the demographic variables, 57 items were developed for the questionnaire. Two groups of firms were established in the survey process: those in the process of implementing an EMS and those without an EMS, with the benefits of an EMS and the barriers to EMS implementation listed. The developed questionnaire was then sent to practitioners and expert academics for refinement. Once the questionnaire was modified based on their feedback, it was administered in the survey distribution process, as discussed in the next chapter.

CHAPTER 5

ADMINISTRATION AND ANALYSIS OF SURVEY

5.1 INTRODUCTION

The previous chapter presented the research hypotheses, followed by the development of the questionnaire. The chapter also mentioned that the prepared questionnaire was sent to several academics and practitioners for feedback and refinement. Once the questionnaire was fine-tuned based on their feedback, it was distributed to Australian food directors and managers from two groups of firms: the best 100 Australian food manufacturing firms and food firms certified under the Joint Accreditation System of Australia and New Zealand (JAS-ANZ). The current chapter seeks to explain the outcomes from the survey conducted in EMS-certified firms. Based on Figure 5.1, which illustrates the organisation of this chapter, the chapter comprises three important phases. The first phase, related to the EMS-certified firms, is divided into two important steps: analysis of the demographic information via SPSS and discussion of the SmartPLS procedures for analysing the survey data. The second phase, related to firms in the process of implementing an EMS, comprises two important steps: analysing their demographic information as well as the potential benefits of implementing an EMS, with both steps using SPSS software. Finally, in the third phase, the demographic information and the barriers to implementing an EMS for firms without an EMS were analysed with SPSS software employed for this task.

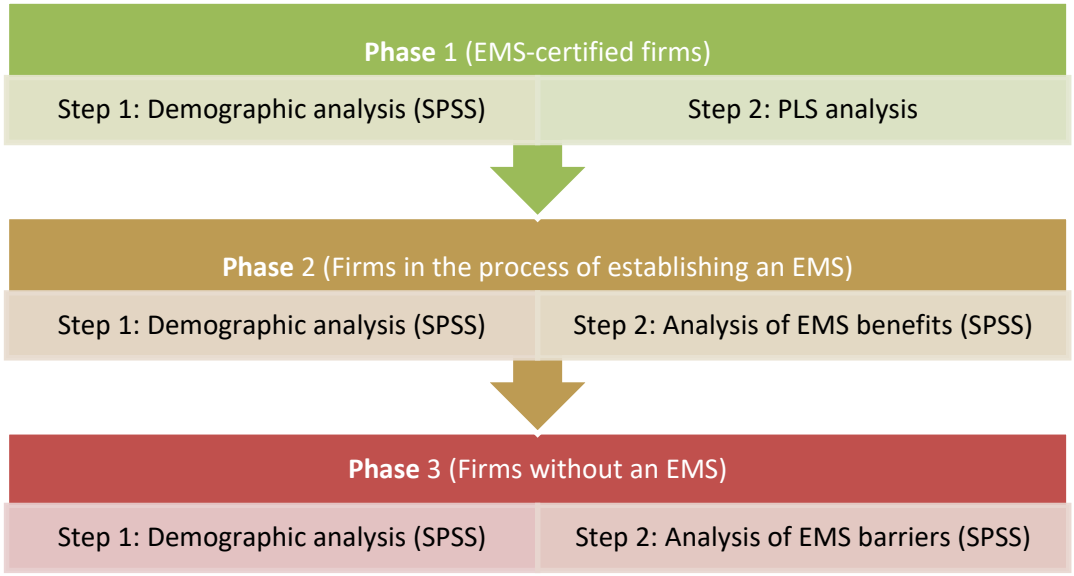

Figure 5.1: Summary of administration analysis

5.2. OVERVIEW OF THE SURVEY

5.2.1 Sample selection and data collection

Respondents in the current study came from the Australian food industry, being directors and managers (in different roles) with responsibility for environmental practices in their firms. Directors and managers were identified from firms' websites and approached via phone, email or LinkedIn to acquire their approval. Those who made contact were then given complete information about the study including the purpose of the study and the targeted sample. They were then asked about the best and most convenient way for them to complete the research survey: this was via the Qualtrics website or by mail. In the mail survey, each package comprised the research instrument as well as the survey cover letter, general instructions, a pre-paid and addressed envelope, and the final research questionnaire (as presented in Appendix). The cover letter stated that participation in this survey was voluntary and that all individual responses would remain anonymous.

5.2.2 Response rate

An important aspect of quantitative research is having a high response rate (Cui, 2003). The researcher therefore sought to motivate respondents to complete the

questionnaire by describing the importance of their participation. By participating, they would help to develop environmental knowledge in the Australian food industry which would directly impact on different aspects, that is, environmental, economic and operational, of firm performance. The design for the study questionnaire was based on non-technical general statements and the avoidance of technical jargon, in line with the total design method (TDM) (Heberlein and Baumgartner 1978, p. 460). The questionnaire designed for the current study was examined by two academic experts specialising in food supply chain management: it was then sent to four practitioners in the food industry. A personalised cover letter, including the Curtin University letterhead, was attached to each questionnaire and explained the importance of participating in this survey.

Respondents were assured that their identities would remain anonymous. Therefore, the survey questionnaire did not include any code or sign to identify the specific responses. For the convenience of respondents, a pre-paid and addressed reply envelope was provided. Respondents were given four weeks to complete and return the questionnaires. After the four weeks had elapsed, phone calls, emails and LinkedIn messages were used to encourage them to return the completed questionnaires.

As mentioned in the previous section (Section 5.1), this study was conducted among three groups of Australian food manufacturing firms. In total, 345 questionnaires were distributed to Australian food directors and managers from two groups of firms comprising the best 100 Australian food manufacturing firms and 70 food firms certified under the Joint Accreditation System of Australia and New Zealand (JAS-ANZ). Overall, 146 questionnaires were returned, thus constituting an approximate effective response rate of 42%. Among the questionnaires, 10 were incompletely filled in: these questionnaires were discarded. Some respondents were also not interested in completing the demographic information. However, taking note of the importance for SmartPLS analysis and SPSS analysis of the completed information in the rest of these incomplete questionnaires, these questionnaires, without

demographic information, were not excluded. The collected data, categorised based on the three groups, are described below in detail:

- **First: Environmental management system (EMS)-certified firms.** This category included 56 respondents; however, only 52 respondents completed the questionnaire with the remaining four questionnaires were excluded. In this group of respondents, SPSS was used to analyse respondents' demographic features. The SmartPLS procedures for analysing the survey data were done in two steps: evaluation of the measurement model and appraisal of the structural model.
- **Second**: **Firms in the process of implementing an environmental management system (EMS).** In this category, 21 respondents completed their questionnaires. In this group of respondents, SPSS was used to analyse respondents' demographic information and the benefits to their firms of EMS implementation.
- **Third**: **Firms without an environmental management system (EMS).** This category included 69 respondents; however, only 63 respondents completed the questionnaire with the remaining five questionnaires excluded. In this group of respondents, SPSS was used to analyse respondents' demographic features and the reasons why their firms were not interested in EMS implementation.

5.2.3 Data organisation

Overall, in this research, about 8% of missing values were excluded from the analysis. Also, the missing data for each group of firms: EMS-certified firms; firms in the process of EMS implementation and, finally, firms without an EMS were about 7%; 0 and 7%, respectively.

The data were also examined to detect errors in terms of invalid data, including missing values or a blank questionnaire, to achieve clean data for the data analysis. However, as mentioned in Section 5.2.2, due to the importance of the collected data, the questionnaires with uncompleted questions in the demographic section were not excluded. Moreover, for PLS analysis, referring to Barclay, Higgins and Thompson (1995, p. 292), the minimum required number of samples in the study should not be less than 10 times the number of items in the most complex formative construct or the largest number of antecedent constructs leading to an endogenous construct in

the study model. Based on this rule, the minimum sample size for this study was 30 samples whereas 52 was the final number of usable responses. Hence the sample size was adequate for PLS analysis.

5.2.4 Sampling error and non-response bias

Only a small number of Australian food firm directors and managers participated in this study; hence, the statistical analysis resulting from their responses is probably dissimilar from what would have been obtained if information had been collected from most Australian food firm directors. This problem is named as 'sampling error'. It has been generally understood that the larger the sample size covered, the lower the sampling error. On the other hand, since effective response rate was 42% it was necessary to test the bias of the non-respondents through statistical analysis.

- **Non-response bias**

The Mann–Whitney U test is a popular method to test non-response bias which is offered for sample sizes larger than 30 (Pallant, 2013). The foundation for applying this test is that late respondents and non-responses are likely to have similar characteristics (Thong 1999, p. 199). Referring to Pallant (2013, p. 237), if the resulting *z*-values are not significant at 0.05; therefore, no statistically significant difference exists between dependent variables and different groups of independent variables. In this study, the Mann–Whitney U test was applied to two groups of respondents: (1) those from EMS-certified firms and (2) those from firms in the process of implementing an EMS, comprising a total of 73 respondents. The difference between these two groups was assessed based on several items of demographic information in this study. The respondents were grouped into two categories: early respondents (n = 34) and late respondents (n = 39). Table 5.1 depicts the Mann–Whitney U test results for EMS-certified firms and for firms in the process of EMS implementation. As shown in Table 5.1, with *z*-values not significant at 0.05 (ie. t-value less than 1.96), all the items passed the non-response bias test. In other words, no significant differences were found between earlier and late responses. Hence, it can be concluded that this study does not have non-response bias.

Table 5.1: Mann–Whitney U test

EMS-certified firms and firms in the process of implementing EMS	*z*-value
Size	-1.434
Position	-0.167
Work experience	-0.214
Education	-0.969
Australian state/territory	-1.661

5.3 DESCRIPTIVE ANALYSIS OF SAMPLE (ENVIRONMENTAL MANAGEMENT SYSTEM [EMS]-CERTIFIED FIRMS)

This section presents in detail the demographic analysis of survey respondents from environmental management system (EMS)-certified firms. As mentioned in Section 5.2.2, the questionnaires which had incomplete demographic sections were not withdrawn from the data analysis due to the importance of the collected data for the PLS analysis. Therefore, demographic data from less than 52 respondents were analysed. To run SPSS, numeric values and scale measurements were used. Information sought in the demographic section for analysis comprised: the respondent's education; length of employment (work experience); position; number of employees in their firm (firm size); annual revenue of their firm; Australian state or territory location of their firm; and product type produced by their firm with these described in the following paragraphs.

5.3.1 Education

This section presents the level of education of research respondents. As shown in Table 5.2, 49 respondents answered this question. More than 79.6% of respondents had higher education, from completing a university degree or a postgraduate degree. The remaining 20.4% of respondents had completed high school education or had a trade qualification. This result emphasised that directors and managers with a good range of education had contributed to this study.

5.3.2 Length of employment

This section presented respondents' work experience, with Table 5.2 presenting the results in detail. Only 49 respondents answered this question. As shown in Table 5.2,

the largest group of respondents (28%) had more than 21 years' work experience. Another significant finding was that 22.4% of respondents were in two other groups (5–10 years; 6–10 years). Only a few respondents (4.1%) had less than one year's experience. This result indicated that the survey questionnaire was completed by highly experienced people with complete familiarity with this specific industry.

5.3.3 Position

This section presents details of respondents' employment positions. Table 5.2 depicts details of each respondent's position. In total, 49 respondents answered this question. As shown in Table 5.2, the largest group of respondents (26.5%) had the position of environmental and quality manager. A significant point is that two other groups of respondents (comprising 20.4%) worked in positions with the titles of area manager or engineering manager. In a similar vein, two more groups of respondents (comprising 12.2%) worked in positions with the titles business manager and supply chain manager. Furthermore, 12.2% of respondents were firm directors. Based on this result, this research has collected valuable information from managers highly experienced in their respective businesses.

5.3.4 Number of employees (firm size)

To analyse firm size, Table 5.2 presents the number of employees in respondents' firms, with 50 respondents answering this question. For EMS-certified firms, those within the range of 200 employees or more had the highest proportion of respondents (66%). The second highest percentage group of respondents (24%) were from firms within the range of 20–199 employees. Only a few respondents were in the other two groups (< 5 employees; 6–19 employees) by 4.0% and 6.0%, respectively. Based on this result, most respondents in this research worked in medium-sized and large firms.

5.3.5 Annual revenue

In this section, respondents were asked about their firm's annual revenue, with the collected information presented in Table 5.2. It was evident that the largest group of respondents (84.6%) worked in firms with the highest annual revenue (over

A$5,000,001). The second highest group of respondents (7.7%) worked in firms with annual revenue from A$1,000,001–A$5,000,000. A significant finding was that a small group of respondents (3.8%) were from firms with annual revenue in the range of < A$250,000 or A$500,001–A$1,000,000. This result confirmed that most respondents were from medium-sized and large firms which confirmed the finding in Section 5.2.4 as large firms generally have large annual revenue. In Section 5.2.4, most respondents were found to be from large and medium-sized firms with the annual revenue finding now confirming that result.

5.3.6 Respondents' Australian state or territory

Table 5.2 shows the Australian state or territory of each respondent, with most respondents (32.7%) being from two locations (New South Wales [NSW], Victoria [VIC]). The second highest group of respondents (13.5%) were from Queensland (QLD). Another finding was that 15.4% of respondents were from two states (South Australia [SA], Western Australian [WA]). Only a few respondents were from the Australian Capital Territory (ACT) and Tasmania (TAS) with 3.8% and 1.9%, respectively. The Northern Territory (NT) had no respondents. These results indicate that most large food manufacturers were located in the states/territories listed above, with the highest representation being in NSW and VIC.

Table 5.2: Demographic information of survey respondents

Education	**No.***	**%**
High school	8	16.3%
Trade qualification	2	4.1%
University degree	19	38.8%
Postgraduate university degree	20	40.8%
Work experience	**No.**	**%**
< 1 year	2	4.1%
1–5 years	5	10.2%
6–10 years	6	12.2%
11–20 years	14	28.6%
> 21 years	22	44.9%
Position	**No.**	**%**
CEO–Director–Owner	6	12.2%
General Manager – Planning	8	16.3%
Business Manager (Purchasing and Marketing Managers)	3	6.1%
Quality and Environmental Manager	13	26.5%
Supply Chain Manager	3	6.1%
Area Manager	5	10.2%
Engineering Manager (Operation, Manufacturing, Technical Managers)	5	10.2%
Other (NPD*, Financial ...)	6	12.2%
Number of employee	**No.**	**%**
< 5 employees	2	4.0%
6–19 employees	3	6.0%
20–199 employees	12	24.0%
> 200 employees	33	66.0%
Annual revenue	**No.**	**%**
< A$250,000	2	3.8%
A$500,001–A$1,000,000	2	3.8%
A$1,000,001–A$5,000,000	4	7.7%
> A$5,000,001	44	84.6%
Australian state/territory	**No.**	**%**
ACT	2	3.8%
NSW	17	32.7%
SA	4	7.7%
TAS	1	1.9%
QLD	7	13.5%
VIC	17	32.7%
WA	4	7.7%

*No = number of respondents
NPD = New Product Development

5.3.7 Product type

Table 5.3 presents the types of product produced by the food firms where respondents worked. As some firms produced several products, it was important in this section that the frequency was reported. As is clear in Table 5.3, data were

collected from respondents working in firms producing various types of product such as meat, poultry, dairy, confectionery, etc. Most data were collected from the dairy industry with 11 respondents. The second largest group of respondents comprised two equal groups (both n = 7) who worked in firms involved in meat processing and fruit and vegetables. Three groups each had the same number of respondents (n = 6) and worked in firms engaged in manufacturing confectionery, snack food or bread. Also, 10 respondents were from firms engaged in wine and fruit juice manufacturing. The result shows that valuable data were collected from a variety of Australian food sectors.

Table 5.3: Types of product

Product	*F	Product	F
Meat Processing	7	Confectionery Manufacturing	6
Poultry Processing	3	Seafood Processing	2
Ice Cream Manufacturing	1	Snack Food Manufacturing	6
Dairy Product Manufacturing	11	Beer and Malt Manufacturing	2
Fruit and Vegetable Processing	7	Wine Manufacturing	5
Oil and Fat Manufacturing	2	Fruit Juice Drink Manufacturing	5
Flour Mill Product Manufacturing	3	Bread Manufacturing	6
Cereal Food and Baking Mix Manufacturing	4	Other	13

*F = frequency

5.4 PARTIAL LEAST SQUARES (PLS)-BASED STRUCTURAL EQUATION MODELLING (SEM) FOR ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)-CERTIFIED FIRMS

In this study, structural equation modelling (SEM) was applied for the quantitative data analysis. Figure 5.2 presents the structural equation modelling (SEM) procedures for this analysis. As seen in this figure, the assessment of the SmartPLS model includes two significant stages:

- assessment of the measurement model
- assessment of the structural model.

In the first stage; assessment of the measurement model was applied for reflective constructs at first-, second- and third-order levels as well as for the formative construct at the second-order level. For reflective constructs, several significant tests were applied including:

- item reliability and *t*- value
- internal consistency
- average variance extracted (AVE)
- discriminant validity

However, for the formative construct, the weighting and *t*-value of the construct were calculated.

In the second stage, assessment of the structural model, path coefficients (β) followed by the amount of variance, shown by the coefficient of determination, R-squared (R^2), were analysed. All these processes are explained in the paragraphs following Figure 5.2.

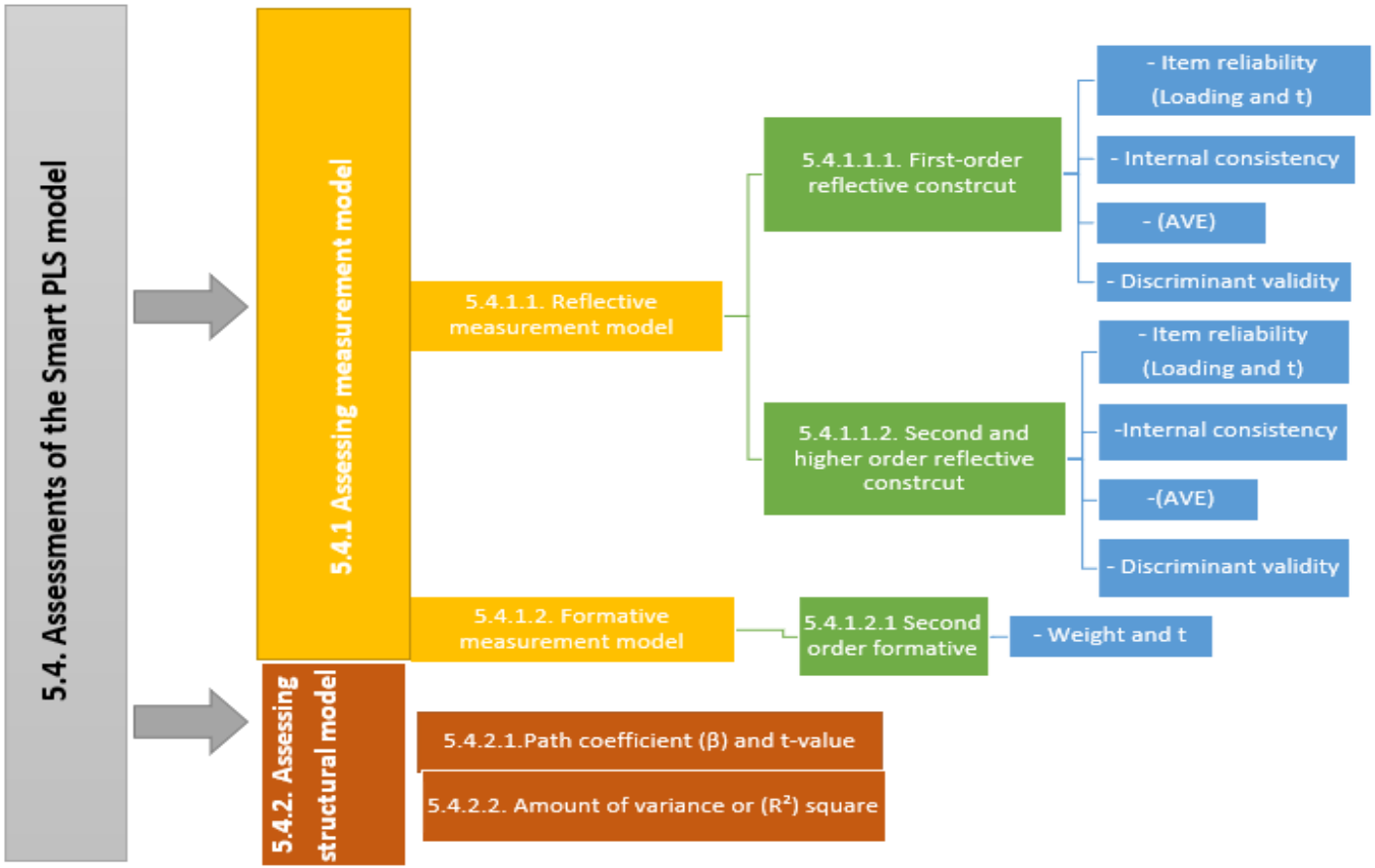

Figure 5.2: Assessments with SmartPLS model

5.4.1 Assessing the measurement model

In the current study, the comprehensive model comprised 18 constructs consisting of first-, second- and third-order constructs which were either reflective or formative. Among the constructs, green supply chain practices (GSCP)s, environmental management system (EMS), external determinants (EXDETs), internal supply determinants (INTDs) and firm performance (PE) were hierarchical and multidimensional. At the third-order level, the hierarchical construct (GSCPs) was measured by three reflective constructs consisting of two first-order constructs: green purchasing (GP) and total quality management (TQM) and one second-order construct, environmental management system (EMS). The second-order construct (EMS) was measured through three first-order sub-constructs: attitude toward environmental management system (EMSAT), benefits of environmental management system (EMSBF) and environmental management system constituents (EMSCO). All these GSCP first-order constructs contained several reflective items.

Moreover, the comprehensive model included two antecedents of GSCPs: external determinants (EXDETs) and internal supply determinants (INTDs) which were both considered as hierarchical multidimensional second-order constructs. At the second-order level, INTDs were measured by two reflective constructs: agility (AG) and internal supply relationships (IRs). In contrast, external determinants (EXDETs) were measured by three formative first-order sub-constructs: government (GOV), suppliers (SUP) and buyers (BUY) with each one measured based on several reflective items. Finally, the hierarchical multidimensional construct performances were modelled as the outcome of the construct, GSCPs, which was measured by three reflective-type sub-constructs: environmental performance (ENVPE), financial performance (FINPE) and operational performance (OPPE). Referring to the prior literature (Barclay, Higgins, and Thompson, 1995, p. 297; Santosa, Wei, and Chan, 2005, p. 365), the entire reflective measurement model was assessed based on item reliability, internal consistency, average variance extracted (AVE), correlation of the constructs and discriminant validity, whereas the formative model was assessed by the item-level weight and *t*-statistics of the constructs. The following sections discuss

the analysis of the measurement constructs based on the outcome of the PLS analysis run.

5.4.1.1 Assessment of the reflective measurement model

In this research, the reflective measurement model consisted of first-, second- and third-order level constructs. The first-order measurement model was firstly evaluated then the second- and third-order level models were measured.

5.4.1.1.1 First-order reflective measurement model

Based on the comprehensive research model in Figure 5.3, it is evident that the model includes several first-order reflective-type sub-constructs each of which has its measurement items. The details of the coding of the first-, second- and third-order constructs were discussed in detail in Chapter 4. However, in this study, as shown in Figure 5.3, two different groups of first-order reflective sub-constructs are included:

- First-order reflective sub-constructs from reflective higher-order constructs including: agility (AG1–AG4); internal supply relationships (IR1–IR6); environmental performance (ENVPE1–ENVPE4); financial performance (FINPE1–FINPE4); operational performance (OPPE1–OPPE4); total quality management (TQM1–TQM5); green purchasing (GP1–GP5); attitude toward environmental management system (EMSAT1–EMSAT3); environmental management system benefits (EMSBF1–EMSBF6); and environmental management system constituents (EMSCO1–EMSCO4).
- First-order reflective sub-construct form the formative higher-order constructs including suppliers (SUP1–SUP5); buyers (BUY1–BUY4); and government (GOV1–GOV3).

These two different groups of reflective sub-constructs were measured in terms of item reliability, internal consistency and discriminant validity with reference to previous studies (Hair, Ringle, and Sarstedt, 2011; Barclay, Higgins, and Thompson, 1995; Ringle, Sinkovics and Henseler, 2009).

- ***Item reliability***

The first step to assess the measurement model is determining item reliability. According to Tomson (1995, p. 295), item reliability is an analysis of the estimation of the amount of variance that occurs in each measurement item due to the construct. To determine item reliability, as part of assessing the reflective measurement model, it is important to consider two significant steps:

First step: in this first step, all the first-order construct items were repeated in their higher-order constructs (including second- and third-order constructs) (Becker, Klein and Wetzels, 2012). Table 5.4 shows the process of repetition in the second- and third-order constructs. The repetition factor process shown in Table 5.4 is explained below:

- for the first-order constructs, agility (AG1–AG4) and internal supply relationships (IR1–IR6), all the factors were repeated in their second-order construct, internal supply determinants (INTDs);
- for the first-order constructs: environmental performance (ENVPE1–ENVPE4); financial performance (FINPE1–FINPE4); and operational performance (OPPE1–OPPE4), all the factors were repeated in the second-order construct, firm performance (PE);
- for the first-order constructs: total quality management (TQM1–TQM5) and green purchasing (GP1–GP5, all the factors were repeated in the second-order construct, green supply chain practices (GSCPs).
- for suppliers (SUP1–SUP5); buyers (BUY1–BUY4); and government (GOV1–GOV3), all these first-order factors were repeated in the second-order construct, external determinants (EXDETs).

As a second-order construct, environmental management system (EMS) included three first-order constructs: attitude toward environmental management system (EMSAT1–EMSAT3); environmental management system benefits (EMSBF1–EMSBF6); and environmental management system constituents (EMSCO1–EMSCO3); all these first-order measurement factors were repeated in either EMS as a second-order construct or GSCPs as a third-order construct.

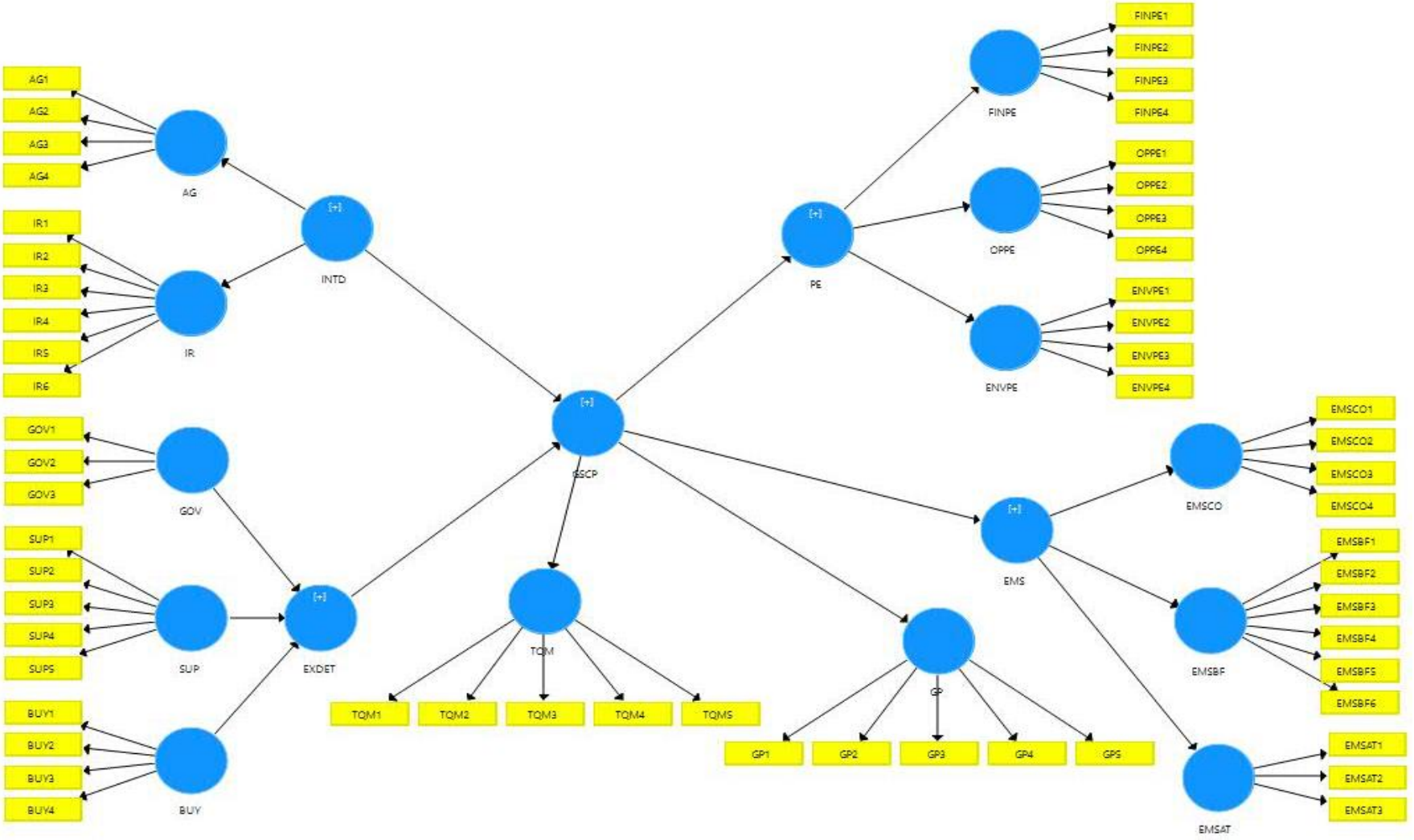

Figure 5.3: Research model in SmartPLS environment

Table 5.4: Item repetition in each construct

First-order construct measurement items	Repeated in second-order construct	Repeated in third-order construct
Agility (AG1–AG4) Internal supply relationships (IR1–IR6)	Internal supply determinants (INTDs)	-
Environmental performance (ENVPE1–ENVPE4) Financial performance (FINPE1–FINPE4) Operational performance (OPPE1–OPPE4)	Firm performance (PE)	-
Total quality management (TQM1–TQM5) Green purchasing (GP1–GP5)	Green supply chain practices (GSCPs)	-
Attitude toward environmental management system (EMSAT1–EMSAT3) Environmental management system benefits (EMSBF1–EMSBF6) Environmental management system constituents (EMSCO1–EMSCO4)	Environmental management system (EMS)	Green supply chain practices (GSCPs)
Suppliers (SUP1–SUP5) Buyers (BUY1–BUY4) Government (GOV1–GOV3)	External determinants (EXDETs)	-

Second step: in this second step, the SmartPLS algorithm was applied, and to achieve a higher loading in both first- and higher-order levels, low-loading items were deleted one by one. Referring to Chin (1998a, p. xiii), the acceptable load should be at least 0.6. In the following paragraphs, the process of data analysis in two levels, first-order reflective construct and second-order reflective construct, is presented in detail. Following the suggestion of researchers (e.g., Hair, Ringle, and Sarstedt, 2011; Barclay, Higgins, and Thompson, 1995; Ringle, Sinkovics and Henseler, 2009), the cut-off value settled on for this study was 0.6, with the aim of maximising the convergent validity of the measurement model. In Table 5.5, the details of the item loadings with corresponding *t*-values are shown.

- ***Internal consistency (composite reliability)***

As shown in Table 5.5, internal consistency (composite reliability [CR]) values for all constructs used in this study were proposed. According to Bagozzi and Yi (1998) and Henseler, Ringle and Sinkovics (2009), the cut-off point value for internal consistency is 0.6. As shown in Table 5.5, the internal consistency values for all constructs were over 0.7, thus referring to the cut-off point value of Bagozzi and Yi (1998) and Ringle, Sinkovics and Henseler (2009). Barclay, Higgins, and Thomson (1995) however

surpassed the minimum desired value of 0.7 or over. It is noteworthy to consider that internal consistency values for all constructs, except green purchasing (GP: 0.738) and agility (AG: 0.763) were over 0.8 thus referring to Barclay, Higgins, and Thomson (1995, p. 297). For this study, composite reliability (CR) was greater than the minimum desirable value, thus indicating it was reliable for further analysis.

- ***Average variance extracted (AVE)***

In this study, the average variance extracted (AVE) of each construct was measured. Table 5.5 presents the AVE results for each construct in the comprehensive research model. In reference to Fornell and Larcker (1981); Ringle, Sinkovics and Henseler (2009); and Hair, Ringle and Sarstedt (2011), the AVE for reflective constructs should be greater than 0.5. As shown in Table 5.5, the discriminant validity for all constructs is greater than 0.5 which conforms to the guidelines of Fornell and Larcker (1981) and Hair, Ringle and Sarstedt (2011).

Table 5.5: Assessment of reliability, CR and AVE for first-order constructs

Constructs	**First-order level Corresponding sub-constructs**	**Loading**	***t*-Value**	**CR**	**AVE**
Attitude to environmental management system (EMSAT)	EMSAT 1	0.907	35.928	0.927	0.809
	EMSAT 2	0.849	14.934		
	EMSAT 3	0.941	69.358		
Environmental management system benefits (EMSBF)	EMSBF 1	Deleted	Deleted	0.828	0.549
	EMSBF 2	0.626	4.974		
	EMSBF 3	0.724	7.142		
	EMSBF 4	0.770	8.997		
	EMSBF 5	Deleted	Deleted		
	EMSBF 6	0.829	11.987		
Environmental management system constituents (EMSCO)	EMSCO1	Deleted	Deleted	0.811	0.591
	EMSCO2	0.683	4.904		
	EMSCO3	0.859	7.881		
	EMSCO4	0.755	4.461		
Green purchasing (GP)	GP1	0.883	12.101	0.738	0.497~0.5*
	GP2	0.484	2.748		
	GP3	Deleted	Deleted		
	GP4	0.691	4.787		
	GP5	Deleted	Deleted		
Total quality management (TQM)	TQM1	0.908	35.171	0.894	0.739
	TQM2	0.919	40.635		
	TQM3	Deleted	Deleted		
	TQM4	0.741	5.822		

	TQM5	Deleted	Deleted		
Agility (AG)	AG1	Deleted	Deleted	0.759	0.519
	AG2	0.841	13.614		
	AG3	0.738	4.639		
	AG4	0.553*	2.133		
Internal supply relationships (IRs)	IR1	Deleted	Deleted	0.942	0.844
	IR2	Deleted	Deleted		
	IR3	0.912	25.836		
	IR4	0.906	30.014		
	IR5	0.937	46.511		
	IR6	Deleted	Deleted		
Environmental performance (ENVPE)	ENVPE1	0.611	3.118	0.823	0.613
	ENVPE2	0.869	21.263		
	ENVPE3	0.843	13.538		
	ENV PE4	Deleted	Deleted		
Operational performance (OPPE)	OPPE1	0.874	4.305	0.820	0.537
	OPPE2	0.718	2.689		
	OPPE3	0.713	3.226		
	OPPE4	0.600	2.086		
Financial performance (FINPE)*	FINPE1	0.951	53.530	0.945	0.895
	FINPE2	0.941	34.456		
	FINPE3	Deleted	Deleted		
	FINPE4	Deleted	Deleted		
Government (GOV)*	GOV1	Deleted	Deleted	0.855	0.747
	GOV2	0.840	1.767		
	GOV3	0.887	1.872		
Buyers (BUY)	BUY1	Deleted	Deleted	0.770	0.531
	BUY2	0.616	2.978		
	BUY3	0.826	6.351		
	BUY4	0.729	2.726		
Suppliers (SUP)	SUP1	Deleted	Deleted	0.762	0.519
	SUP2	Deleted	Deleted		
	SUP3	0.754	4.038		
	SUP4	0.765	6.050		
	SUP5	0.635	1.926		

Note: *Several important points in relation to Table 5.5 are described below:*

1. *GP ~ AVE is 0.497 which is considered as 0.5 and acceptable.

2. *AG4 = 0.554: Low loading; *t*-value = 2.257. This item is acceptable because the *t*-value is significant.

******After deleting low-loading and not significant factors for the first-order reflective sub-constructs, only two factors are left in each of the two dimensions, government and financial performance. This is similar to the situation in the previous study by Mirghafouri et al. (2017) about "developing green performance through supply chain

agility" in ceramic tile firms in Yazd. In the study by Mirghafouri et al. (2017) after deleting low-loading factors, only two factors were left in each of two dimensions, financial performance and green product agility. Therefore, in reference to that study, for the current study, these two dimensions were acceptable and kept for further data analysis.

3. In Table 5.5, all the measurements (loading, *t*-value, CR and AVE) are related to the first-order reflective sub-constructs. However, in the current study, as mentioned in subsection 5.4.1.1, the two different groups in the first-order reflective mode comprise first-order reflective sub-constructs from the higher-order reflective mode and first-order reflective sub-constructs from formative higher-order constructs. The measurement items in Table 5.5 were extracted from two different models: the first model and the final model:
    a. for the first-order reflective sub-constructs from the formative higher-order constructs comprising GOV, SUP and BUY, the measurements were extracted from the first model (Figure 5.3). The reason was that, in the final model, these first-order sub-constructs were replaced with the latent variable so no measurements have been taken for them. (The higher-order formative construct is described later in subsection 5.4.1.2 and the final model is presented in Figure 5.19.)
    b. for the first-order reflective sub-constructs from the reflective higher-order constructs, the measurements were extracted from the final model (see Figure 5.19**).**

Discriminant validity

Discriminant validity was carried out as the fourth step in the evaluation of the measurement model. It refers to the degree to which constructs differ from each other (Barclay, Higgins and Thomson, 1995, p. 295). This test statistically shows the degree of variance shared between the items and constructs in the model. Two analytical procedures were used for assessing discriminant validity (Barclay, Higgins, and Thompson, 1995; Hair, Ringle and Sarstedt, 2011). The first relates to the comparison of AVE with inter-construct correlations. Using this procedure, if the AVE

for one construct is greater than their shared variance, discriminant validity is adequate (Fornell and Larcker, 1981, p. 49). In the second procedure for analysing discriminant validity, the cross-loadings for each item should be measured and compared across all constructs. Using this procedure, to satisfy the criteria for discriminant validity through the cross-loading matrix**,** the loading of an item within a construct should not be less than its loading with any other construct (Hair, Ringle, and Sarstedt, 2011; Ringle, Sinkovics and Henseler, 2009).

Important: In this study, discriminant validity in both inter-construct correlations and cross-loadings was presented twice. As previously mentioned, the reason was that, in the final model, no first-order reflective sub-constructs were derived from the formative higher-order construct so, firstly, discriminant validity including inter-construct correlations (Table 5.6) and the cross-loading matrix (Table 5.7) was presented for first-order sub-constructs from the first model before being replaced with the latent variable. Discriminant validity was then presented again in terms of inter-construct correlations (Table 5.8) and the cross-loading matrix (Table 5.9) for 10 first-order reflective sub-constructs from the final model after replacement with the latent variable (see Figure 5.19).

As shown in Tables 5.6 and 5.8, for inter-construct correlations, the square root of AVE was greater than the off-diagonal elements across the rows and down the columns, indicating that these results were satisfactory for both models. The results in the form of loading and cross-loading matrices are presented in Tables 5.7 and 5.8. These results indicate that, in both models, all items have higher loadings in their respective constructs in comparison to their cross-loadings in other constructs, thus indicating that these results are acceptable.

Table 5.6: Discriminant validity of inter-construct correlations: Fornell–Larcker criterion (first model before replacement with latent variable)

	AG	BUY	EMSAT	EMSBF	EMSCO	ENVPE	FINPE	GOV	GP	IR	OPPE	SUP	TQM
AG	0.724												
BUY	0.538	0.729											
EMSAT	0.305	0.296	0.900										
EMSBF	0.299	0.022	0.395	0.741									
EMSCO	0.156	0.132	0.328	0.618	0.769								
ENVPE	0.387	0.151	0.242	0.342	0.408	0.783							
FINPE	0.223	0.118	0.297	0.339	0.369	0.482	0.946						
GOV	0.307	0.217	0.362	0.309	0.210	0.205	0.277	0.864					
GP	0.342	0.401	0.406	0.361	0.263	0.168	0.160	0.110	0.706				
IR	0.491	0.299	0.531	0.255	0.270	0.063	0.338	0.108	0.439	0.919			
OPPE	0.221	0.177	0.305	0.221	0.320	0.443	0.106	-0.115	0.300	0.042	0.733		
SUP	0.266	0.559	0.060	0.123	0.173	0.187	0.033	0.025	0.464	0.076	0.283	0.720	
TQM	0.145	0.219	0.701	0.450	0.435	0.320	0.360	0.386	0.432	0.310	0.368	0.084	0.860

Table 5.7: Discriminant validity of cross-loadings for each item (first model before replacement with latent variable)

	AG	BUY	EMSAT	EMSBF	EMSCO	ENVPE	FINPE	GOV	GP	IR	OPPE	SUP	TQM
AG2	0.793	0.273	0.358	0.371	0.252	0.287	0.289	0.327	0.241	0.454	0.195	0.012	0.283
AG3	0.796	0.526	0.367	0.169	0.004	0.484	0.245	0.233	0.353	0.365	0.340	0.291	0.182
AG4	0.558	0.415	-0.242	0.042	0.055	-0.039	-0.187	0.041	0.111	0.199	-0.181	0.375	-0.329
BUY2	0.530	0.616	0.132	0.068	0.104	0.151	-0.049	0.222	0.132	0.128	0.198	0.220	0.033
BUY3	0.410	0.826	0.309	0.030	0.086	0.128	0.147	0.316	0.376	0.226	0.173	0.536	0.272
BUY4	0.266	0.729	0.172	-0.048	0.108	0.054	0.125	-0.110	0.331	0.297	0.012	0.415	0.123
EMSAT1	0.253	0.271	0.907	0.347	0.295	0.185	0.290	0.306	0.425	0.588	0.157	-0.003	0.627
EMSAT2	0.353	0.260	0.849	0.275	0.160	0.243	0.175	0.302	0.346	0.406	0.363	0.142	0.557
EMSAT3	0.230	0.270	0.941	0.433	0.411	0.229	0.325	0.366	0.326	0.436	0.313	0.034	0.702
EMSBF2	0.342	-0.046	0.219	0.626	0.401	0.315	0.365	0.356	0.323	0.202	0.038	0.018	0.290
EMSBF3	0.015	-0.114	0.237	0.724	0.390	0.100	0.058	0.079	0.156	0.130	0.161	0.037	0.294
EMSBF4	0.310	0.099	0.371	0.770	0.551	0.317	0.404	0.319	0.261	0.273	0.243	0.208	0.355
EMSBF6	0.232	0.070	0.320	0.829	0.479	0.283	0.205	0.197	0.332	0.161	0.175	0.074	0.383
EMSCO2	0.079	0.037	0.270	0.390	0.683	0.106	0.281	0.202	0.166	0.266	0.126	0.173	0.194
EMSCO3	0.175	0.217	0.316	0.481	0.859	0.478	0.313	0.117	0.247	0.198	0.456	0.249	0.424
EMSCO4	0.076	-0.022	0.148	0.579	0.754	0.256	0.259	0.209	0.177	0.186	0.029	-0.085	0.342
ENVPE1	0.294	-0.012	0.118	0.320	0.306	0.611	0.192	0.063	0.196	0.145	0.355	0.038	0.171
ENVPE2	0.296	0.048	0.160	0.289	0.260	0.869	0.478	0.205	0.099	-0.009	0.283	0.210	0.172
ENVPE3	0.340	0.268	0.272	0.241	0.413	0.843	0.398	0.178	0.144	0.065	0.437	0.148	0.392
FINPE1	0.360	0.192	0.235	0.251	0.256	0.489	0.951	0.254	0.130	0.320	0.122	0.094	0.281
FINPE2	0.048	0.023	0.332	0.398	0.451	0.421	0.941	0.271	0.175	0.320	0.076	-0.038	0.407
GOV2	0.285	0.120	0.338	0.439	0.272	0.254	0.346	0.840	0.145	0.064	-0.048	0.046	0.428
GOV3	0.250	0.246	0.292	0.122	0.105	0.113	0.150	0.887	0.053	0.119	-0.143	0.001	0.254
GP1	0.261	0.270	0.376	0.258	0.170	0.097	0.102	0.043	0.864	0.324	0.325	0.336	0.390
GP2	0.547	0.267	0.191	0.275	0.372	0.224	0.109	0.242	0.489	0.396	0.281	0.202	0.142
GP4	0.053	0.338	0.263	0.265	0.110	0.093	0.140	0.029	0.714	0.271	0.048	0.429	0.329
IR3	0.505	0.293	0.403	0.265	0.294	0.153	0.350	0.043	0.336	0.913	0.105	0.112	0.227

IR4	0.397	0.253	0.511	0.248	0.220	-0.016	0.275	0.076	0.414	0.904	-0.004	0.021	0.248
IR5	0.447	0.278	0.552	0.190	0.229	0.032	0.304	0.179	0.462	0.938	0.012	0.073	0.378
OPPE1	0.241	0.182	0.278	0.058	0.126	0.353	0.152	-0.098	0.331	0.074	0.874	0.282	0.277
OPPE2	0.051	0.090	0.151	0.192	0.386	0.354	0.090	-0.083	0.174	0.052	0.718	0.157	0.321
OPPE3	0.073	0.191	0.254	0.215	0.255	0.322	0.035	-0.098	0.224	-0.084	0.713	0.212	0.296
OPPE4	0.317	-0.005	0.203	0.312	0.278	0.282	-0.035	-0.049	0.064	0.081	0.600	0.141	0.186
SUP3	0.176	0.403	0.200	0.051	-0.021	-0.003	0.054	-0.065	0.557	0.139	0.271	0.754	0.159
SUP4	0.306	0.408	0.008	0.188	0.238	0.233	0.010	0.175	0.298	0.039	0.267	0.765	0.088
SUP5	0.065	0.402	-0.093	0.005	0.149	0.169	0.006	-0.089	0.128	-0.021	0.046	0.635	-0.089
TQM1	0.192	0.219	0.688	0.352	0.294	0.273	0.299	0.292	0.339	0.307	0.294	0.026	0.908
TQM2	0.084	0.176	0.646	0.439	0.470	0.253	0.284	0.391	0.390	0.247	0.243	0.026	0.919
TQM4	0.094	0.168	0.452	0.373	0.362	0.312	0.365	0.315	0.397	0.245	0.448	0.193	0.740

Table 5.8: Discriminant validity of inter-construct correlations: Fornell–Larcker criterion (final model after replacement with latent variable)

	AG	EMSAT	EMSBF	EMSCO	ENVPE	FINPE	GP	IR	OPPE	TQM
AG	0.720									
EMSAT	0.299	0.900								
EMSBF	0.314	0.395	0.741							
EMSCO	0.176	0.328	0.618	0.769						
ENVPE	0.367	0.242	0.342	0.408	0.783					
FINPE	0.223	0.297	0.339	0.369	0.482	0.946				
GP	0.331	0.407	0.357	0.261	0.165	0.157	0.705			
IR	0.495	0.532	0.255	0.270	0.062	0.338	0.436	0.919		
OPPE	0.205	0.305	0.221	0.320	0.443	0.106	0.306	0.042	0.733	
TQM	0.150	0.701	0.450	0.435	0.320	0.361	0.432	0.310	0.368	0.860

Table 5.9: Discriminant validity of cross-loadings for each item (final model after replacement with latent variable)

	AG	EMSAT	EMSBF	EMSCO	ENVPE	FINPE	GP	IR	OPPE	TQM
AG2	0.841	0.358	0.371	0.252	0.287	0.289	0.245	0.454	0.195	0.283
AG3	0.738	0.367	0.169	0.004	0.484	0.245	0.353	0.364	0.340	0.182
AG4	0.553	-0.242	0.042	0.055	-0.039	-0.187	0.105	0.199	-0.181	-0.329
EMSAT1	0.253	0.907	0.347	0.295	0.185	0.290	0.425	0.589	0.157	0.627
EMSAT2	0.327	0.849	0.275	0.160	0.243	0.175	0.348	0.406	0.363	0.557
EMSAT3	0.238	0.941	0.433	0.411	0.229	0.325	0.328	0.437	0.313	0.701
EMSBF2	0.354	0.219	0.626	0.401	0.315	0.365	0.324	0.203	0.038	0.290
EMSBF3	0.021	0.237	0.724	0.390	0.100	0.058	0.151	0.130	0.161	0.294
EMSBF4	0.321	0.371	0.770	0.551	0.317	0.404	0.255	0.272	0.243	0.355
EMSBF6	0.248	0.320	0.829	0.480	0.283	0.205	0.331	0.161	0.175	0.383
EMSCO2	0.093	0.270	0.390	0.683	0.106	0.281	0.163	0.266	0.126	0.194
EMSCO3	0.178	0.316	0.481	0.859	0.478	0.313	0.244	0.197	0.456	0.424
EMSCO4	0.115	0.148	0.579	0.755	0.256	0.259	0.177	0.186	0.029	0.341
ENVPE1	0.284	0.118	0.320	0.306	0.611	0.192	0.199	0.144	0.355	0.171
ENVPE2	0.281	0.160	0.289	0.260	0.869	0.478	0.096	-0.010	0.283	0.172
ENVPE3	0.317	0.272	0.241	0.413	0.843	0.398	0.139	0.064	0.437	0.392
FINPE1	0.357	0.235	0.251	0.256	0.489	0.951	0.128	0.319	0.122	0.282
FINPE2	0.052	0.332	0.398	0.451	0.421	0.941	0.172	0.320	0.076	0.407
GP1	0.253	0.376	0.258	0.170	0.097	0.102	0.883	0.324	0.325	0.391
GP2	0.551	0.190	0.275	0.372	0.224	0.109	0.484	0.396	0.281	0.142
GP4	0.036	0.263	0.266	0.110	0.093	0.140	0.691	0.272	0.048	0.329
IR3	0.508	0.403	0.265	0.294	0.153	0.350	0.333	0.912	0.105	0.227

	AG	EMSAT	EMSBF	EMSCO	ENVPE	FINPE	GP	IR	OPPE	TQM
IR4	0.408	0.511	0.248	0.220	-0.016	0.275	0.408	0.906	-0.003	0.248
IR5	0.446	0.552	0.190	0.229	0.032	0.304	0.462	0.937	0.012	0.378
OPPE1	0.227	0.278	0.058	0.125	0.353	0.152	0.340	0.073	0.874	0.277
OPPE2	0.028	0.151	0.192	0.385	0.354	0.090	0.176	0.051	0.718	0.321
OPPE3	0.063	0.254	0.216	0.255	0.322	0.035	0.224	-0.084	0.713	0.296
OPPE4	0.322	0.203	0.312	0.278	0.282	-0.035	0.070	0.080	0.600	0.186
TQM1	0.192	0.688	0.352	0.294	0.273	0.299	0.344	0.306	0.294	0.908
TQM2	0.093	0.646	0.439	0.470	0.253	0.284	0.388	0.247	0.243	0.919
TQM4	0.096	0.452	0.373	0.362	0.311	0.365	0.394	0.245	0.448	0.741

5.4.1.1.2 Second-order and higher-order reflective measurement model

The measurement properties of the reflective constructs were assessed for reliability, internal consistency and AVE, as shown in Table 5.10. This subsection presents the complete data analysis for the second-order reflective constructs: internal supply determinants (INTDs), green supply chain practices (GSCPs), environmental management system (EMS) and firm performance (PE).

Table 5.10 presents the second-order construct 'internal supply determinants (INTDs)' and its association with its corresponding first-order sub-constructs and its measurable items. The second-order construct 'internal supply determinants (INTDs)' was measured by the first-order reflective constructs, 'agility (AG)' and 'internal supply relationships (IRs)', with each one comprising several items as mentioned in subsection 5.4.1.1.1. The process of converting the INTDs construct is shown from Figures 5.4–5.7. Figure 5.4 shows the INTDs construct with all its factors including the first-order construct and the repeated factors in the second-order construct. Figure 5.5 presents the INTDs construct without showing the repeated factors in the second-order construct. In Figure 5.6, only the acceptable factors for the construct INTDs are presented after deleting the low-loading factors. Finally, Figure 5.7 presents the INTDs construct at the higher-order level.

The analysis results from the measurement of internal supply determinants (INTDs) (at the second-order level) are shown in Table 5.10. As shown in this table, the loading of each construct score, as it corresponds to internal supply determinants (INTDs), is over 0.6 which is greater than the cut-off value of 0.6, following Chin (1998a, p. xiii). Based on the results revealed in Table 5.10, the *t*-values corresponding to the loadings of the construct scores are all significant. In addition, as can be seen in Table 5.8, the internal consistency (CR) for the INTDs construct is 0.860 which is above the acceptable limit of 0.6, following Barclay, Higgins and Thompson (1995). Furthermore, the AVE result shows that the convergent validity of this model is 0.577, which is greater than the threshold level of 0.5 and is thus acceptable, with reference to Hair, Ringle and Sarstedt (2011).

Table 5.10: Second-order construct, INTD, and its corresponding first-order sub-constructs

Higher-order constructs	First-order construct	Loading	*t*-Value	CR	AVE
Internal supply determinants INTDs)	Agility (AG)	0.691	7.914	0.862	0.577
	Internal supply relationships (IRs)	0.962	105.603		

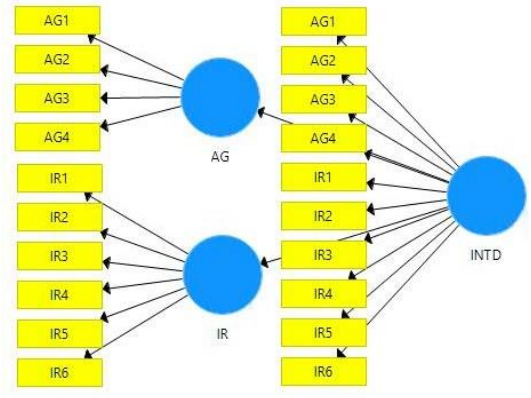

Figure 5.4: INTD construct with repeated factors

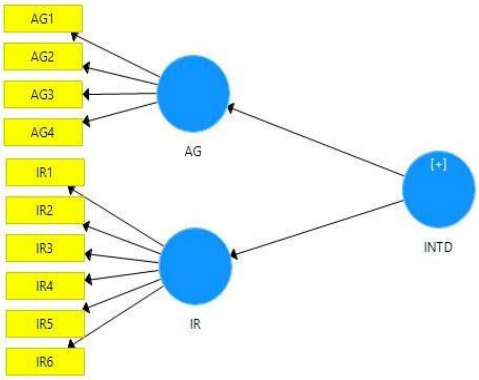

Figure 5.5: INTD construct without showing repeated factors

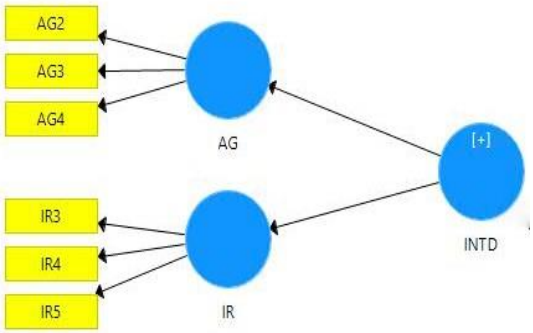

Figure 5.6: INTD construct after deleting low-loading factors

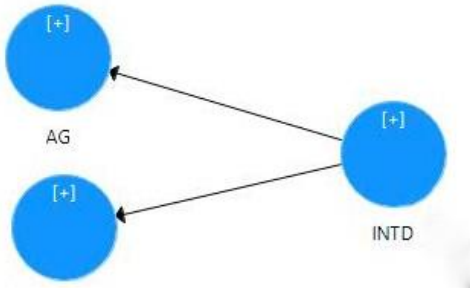

Figure 5.7: INTD construct at higher-order construct level

The construct 'green supply chain practices (GSCPs)' was the second construct to undergo PLS analysis. As with 'internal supply determinants (INTDs)', the higher-order construct 'green supply chain practices (GSCPs)' was measured by two first-order reflective sub-constructs, namely, 'green purchasing (GP)' and 'total quality management (TQM)'. In addition, the higher order construct GSCP was measured by

a third order reflective construct, namely, environment management system (EMS) Table 5.11 presents all the dimensions related to GSCPs as first and second-order constructs. The process of converting the GSCPs construct is shown from Figures 5.8–5.11. Figure 5.8 shows the GSCPs construct with all the first- and second-order constructs and repeated factors in their higher-level construct. Figure 5.9 presents the GSCPs construct without showing the repeated factors in the second- and third-order constructs. Figure 5.10 presents the only acceptable factors for the construct 'GSCPs' after deleting the low-loading factors. Finally, Figure 5.11 presents the GSCPs construct at the higher-order level.

As shown in Table 5.11, the loading of most construct scores corresponds to GSCPs (except for green purchasing [GP]) by being over 0.6 and thus greater than the cut-off value of 0.6, following Chin (1998a, p. xiii). However, it is important to mention that, although the GP loading is less than 0.6, the *t*-value is over 1.96 which is significant so, in reference to Chin (1998a, p. xiii), this is acceptable. Also, based on the results revealed in Table 5.11, all the *t*-values corresponding to loadings of the construct scores are significant. In addition, as seen in Table 5.11, the internal consistency (CR) for this construct is 0.899 which has thus reached the acceptable limit of 0.6, following Barclay, Higgins and Thompson (1995). Furthermore, the AVE result shows that the convergent validity of this second-order model is 0.508 which is above the threshold level of 0.5 and is acceptable with reference to Hair, Ringle and Sarstedt (2011).

Table 5.11: Second-order construct, GSCPs, and its corresponding first-order sub-constructs

Construct	First-order construct	Loading	*t*-Value	CR	AVE
Second-order construct GSCPs	TQM	0.906	37.248	0.899	0.508
	GP	0.559	5.884		
Third-order construct GSCPs	**Second-order construct**	**Loading**	***t*-Value**		
	EMS	0.943	58.678		

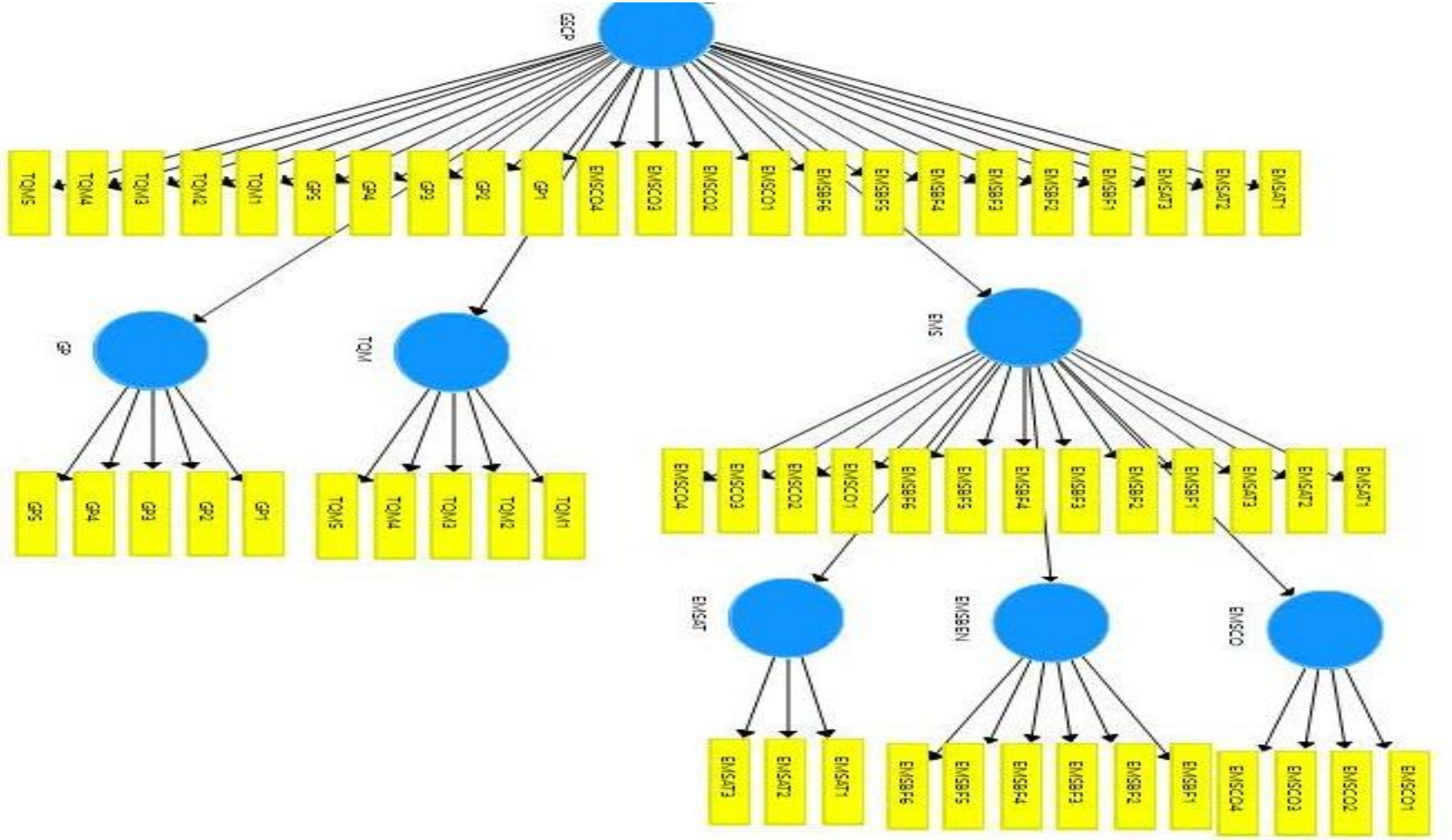

Figure 5.8: GSCP construct with repeated measurement items

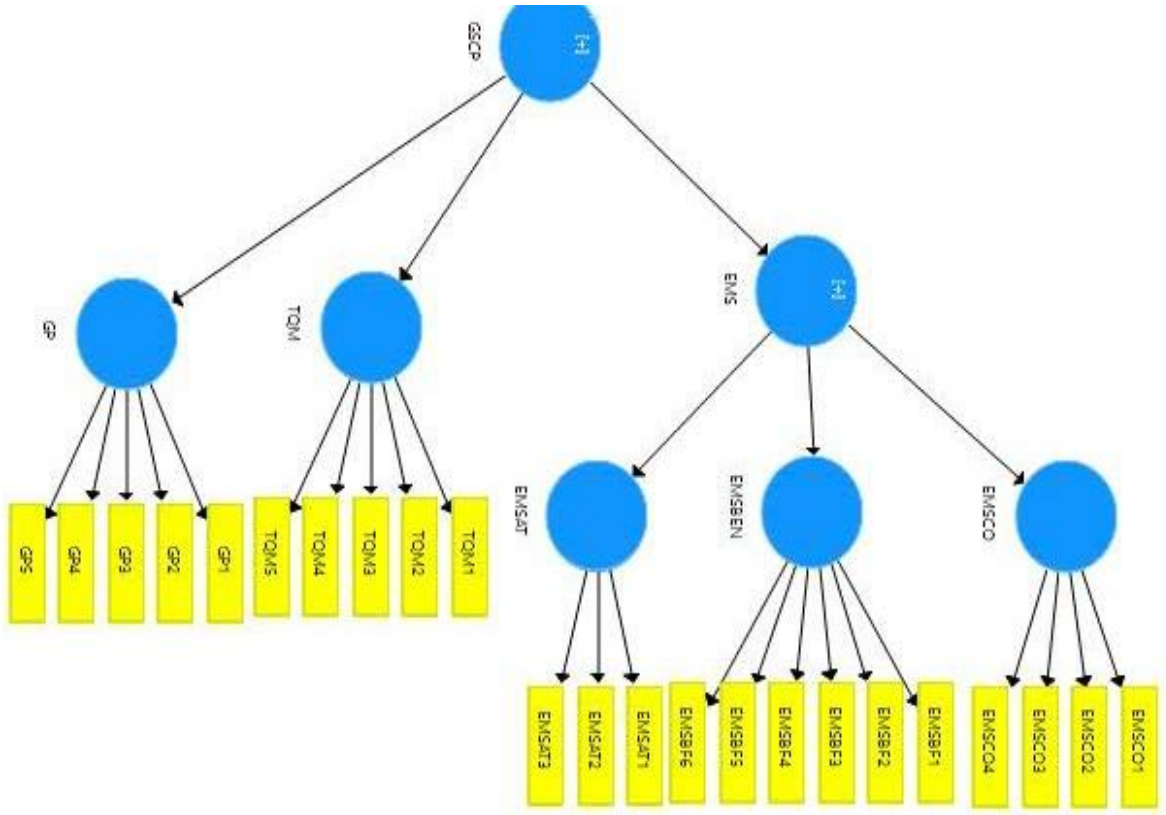

Figure 5.9: GSCP construct without showing repeated factors

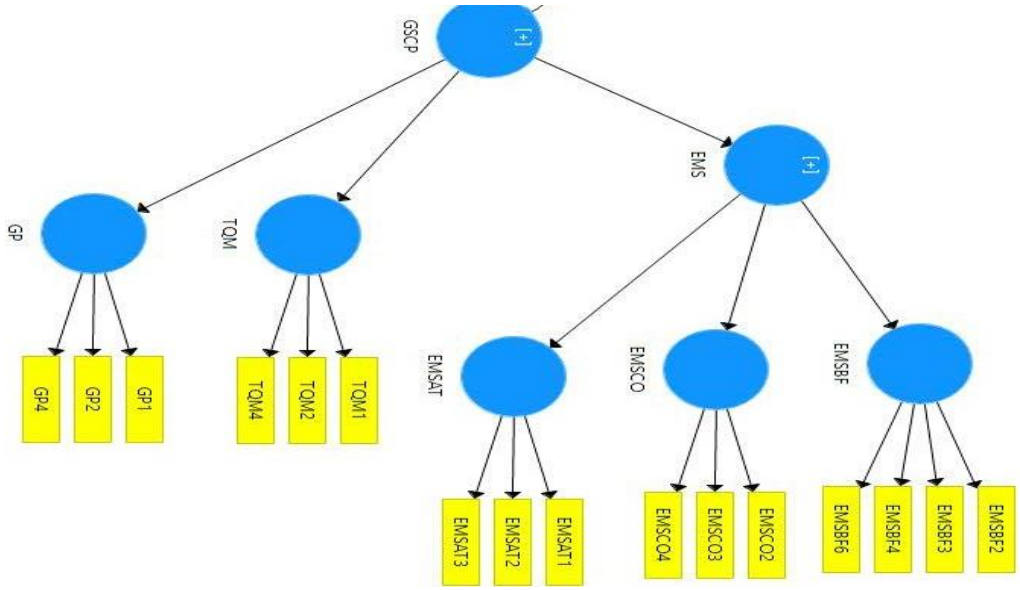

Figure 5.10: GSCP construct after deleting low-loading items

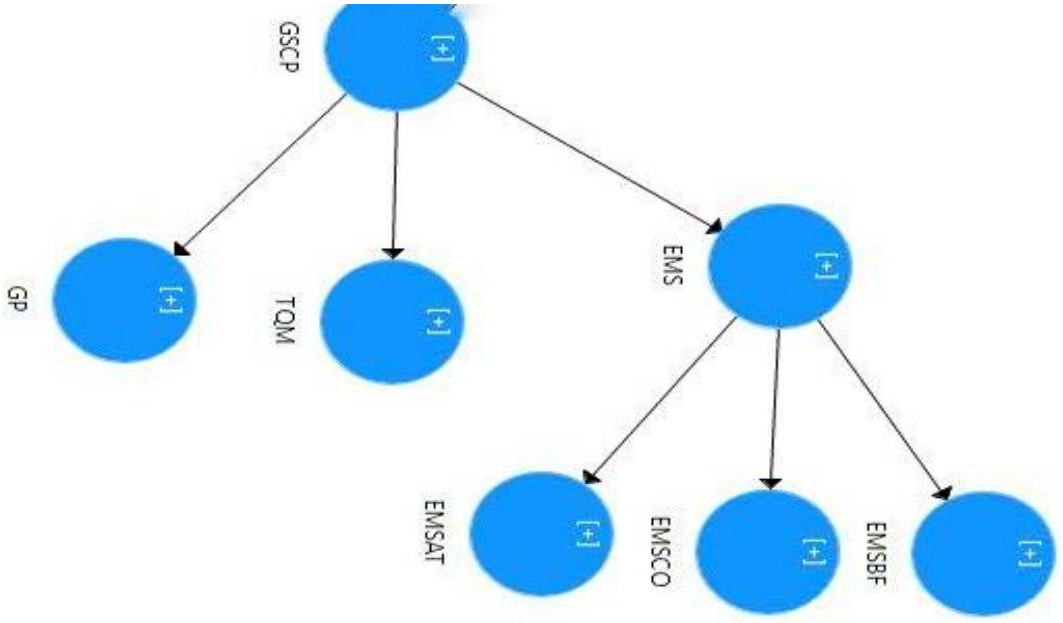

Figure 5.11: GSCP construct at higher-order construct level

The construct 'green supply chain practices (GSCP)' was also considered as the third-order construct for the second-order construct, 'environmental management system (EMS)'. Simply stated, the construct 'environmental management system (EMS)' was measured by several first-order reflective sub-constructs, namely, 'environmental management system benefits (EMSBF)', 'environmental management system constituents (EMSCO)' and 'attitude toward environmental management system (EMSAT)'. Table 5.12 presents all the sub-constructs related to 'environmental management system (EMS)'. The analysis process for the EMS construct is depicted in Figures 5.8–5.11. As shown in Table 5.12, the loading of each construct score corresponding to the construct 'environmental management system (EMS)' is over 0.6 which is greater than the cut-off value of 0.6, following Chin (1998a, p. xiii). Also, based on the result revealed in Table 5.12, all the *t*-values corresponding to the loadings of the construct scores are significant. In addition, as shown in Table 5.12, the internal consistency (CR) for this construct is 0.860 which has reached the acceptable limit of 0.6, following Chin (1998a, p. xiii). Furthermore, the AVE result shows that the convergent validity of the second-order construct EMS is 0.555 which is over 0.5 and is acceptable, as recommended by Hair, Ringle and Sarstedt (2011).

Table 5.12: Second-order construct, EMS, and corresponding first-order sub-constructs

Second-order construct	First-order construct	Loading	*t*-Value	CR	AVE
EMS	EMSAT	0.933	56.067	0.858	0.555
	EMSCO	0.569*	4.951		
	EMSBF	0.614	6.197		

*EMSCO = 0.569, Low loading; t-value = 4.951. This item is acceptable because the t-value is significant.

Another second-order construct presented in this study was 'firm performance (PE)'. Table 5.13 presents this second-order construct and its association with the corresponding first-order sub-constructs. At the higher-order level, the construct 'firm performance (PE)' was measured by several first-order reflective constructs: 'environmental performance (ENVPE)', 'operational performance (OPPE)' and 'financial performance (FINPE)', with each of these constructs measured by several items. The analysis process for the firm performance 'PE' construct is depicted from Figures 5.12–5.15.

Figure 5.12 shows the PE construct with its first-order constructs and repeated factors in their higher-order construct. Figure 5.13 presents the PE construct without showing the repeated factors in the second-order construct. Figure 5.14 presents the only acceptable factor for the PE construct after deleting the low-loading factors. Finally, Figure 5.15 presents the PE construct at the higher-order level. As shown in Table 5.13, the loading of each construct score corresponding to 'firm performance (PE)' is over 0.6 which surpassed the minimum cut-off value of 0.6, following Chin (1998a, p. xiii). Also, in Table 5.13, the *t*-value result shows that all the *t*-values corresponding to the loadings of the construct scores were significant. In addition, as shown in Table 5.13, the internal consistency (CR) for this construct is 0.841 which is greater than the minimum acceptable limit of 0.6, following Barclay, Higgins and Thompson (1995). Furthermore, the AVE result shows that the convergent validity of the second-order construct PE is 0.522 which is greater than 0.5 and is acceptable, with reference to Hair, Ringle and Sarstedt (2011).

Table 5.13 Second-order construct, PE, and corresponding first-order sub-constructs

Second-order construct	First-order construct	Loading	*t*-value	CR	AVE
PE	ENVPE	0.841	19.352	0.841	0.522
	OPPE*	0.450	3.506		
	FINPE	0.840	16.605		

OPPE* = 0.450; low loading; t-value = 3.506. This item is acceptable because the t-value is significant.

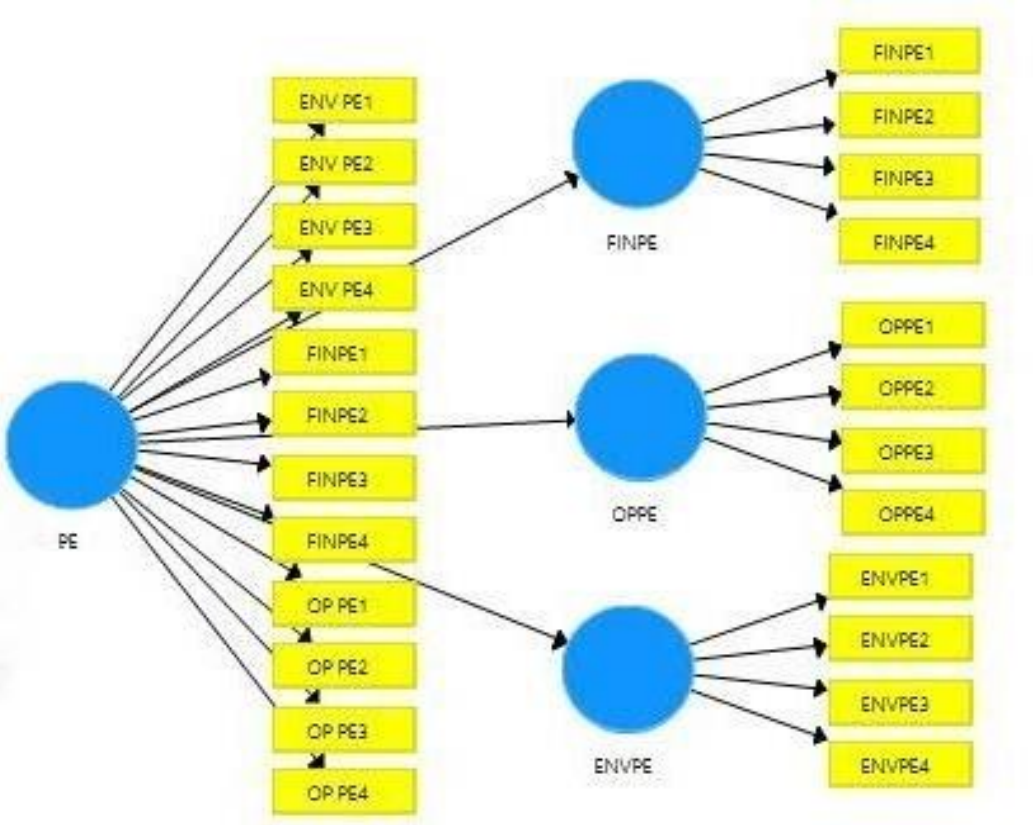

Figure 5.12: PE construct with repeated factors at first- and second-order construct levels

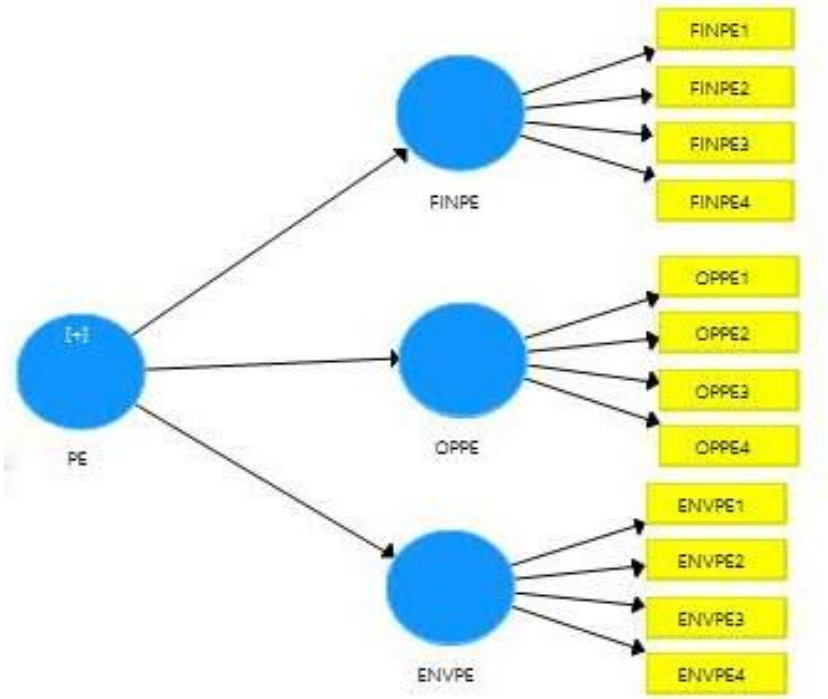

Figure 5.13: PE construct without showing repeated factors at second-order construct level

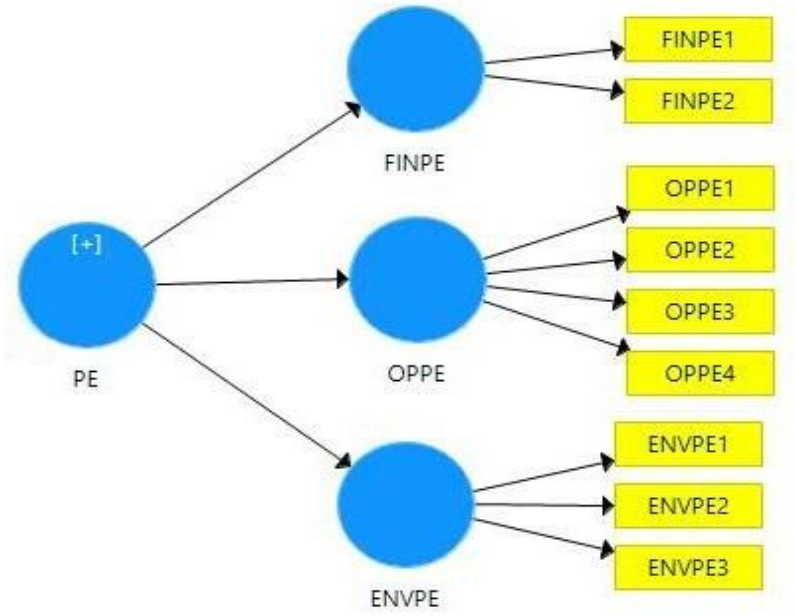

Figure 5.14: PE construct after deletion of low-loading factors

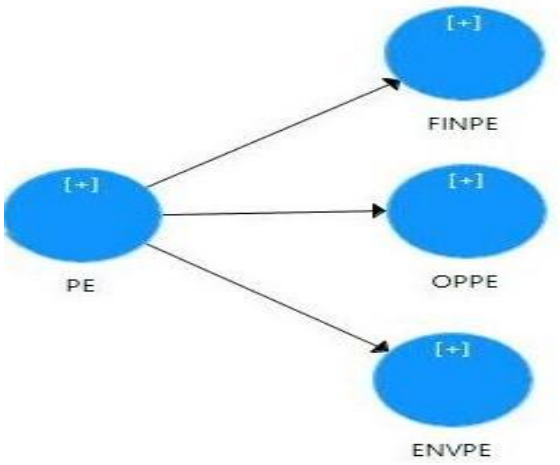

Figure 5.15: PE construct at higher-order

5.4.1.2 Assessing formative measurement model

In this study, the second-order formative construct was 'external determinants (EXDETs)'. This was measured by the following sub-constructs: government (GOV), suppliers (SUP) and buyers (BUY). Figure 5.16 shows the EXDET construct at the second-order level with all factors, while Figure 5.17 shows the EXDET construct at the second-order level. In line with the two-stage approach (see Chapter 3), for analysing formative external constructs, the latent variable was achieved through bootstrapping and then replaced the first-order data. A new model was created and only latent variable scores were considered in this second-order model. Figure 5.18 depicts the replacement by the latent variable in the EXDET construct.

5.4.1.2.1 Second-order formative measurement model

At this stage, each first-order construct was replaced by its latent variable to measure the EXDETs construct (see Figure 5.18). The measurement of the second-order construct, EXDETs, after replacement with the latent variable is presented in Table 5.14. The acceptable *t*-value for formative constructs should be at least 1.96 (Hair, Ringle and Sarstedt, 2011). With a *t*-value of the 'suppliers (SUP)' latent variable of less than 1.96, it did not achieve the desired amount and was not significant in the formation of the higher-order construct 'external determinants (EXDETs)'. The reason for this result was probably because Australian food firm directors and managers in

their decision making about implementing environmental practices pay sufficient attention to the role of suppliers; however, this is an important point and needs to be considered for future studies. The other two latent variables (for BUY and GOV) had *t*-values over 1.96 and were significant. Once the measurement model was refined, it was then put forward for structural model analysis (Ringle, Sinkovics and Henseler, 2009).

Table 5.14: Weighting and *t*-value of latent variables for external determinants

Construct	First-order construct	Weight	*t*-Value
EXDETs	GOV	0.551	2.227
	SUP	-0.128	.338
	BUY	0.780	2.694

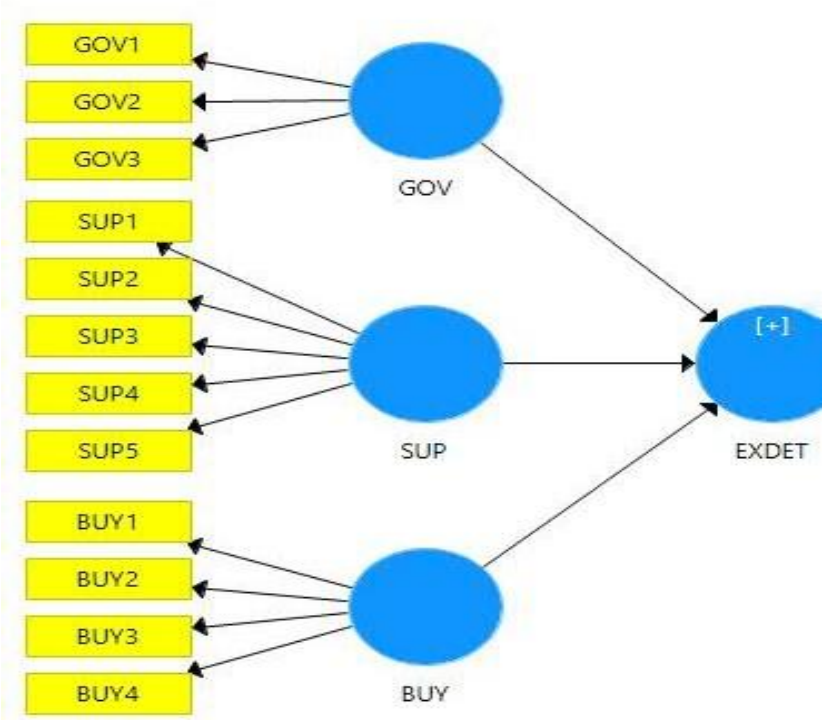

Figure 5.16: EXDET construct at second-order construct level with all factors

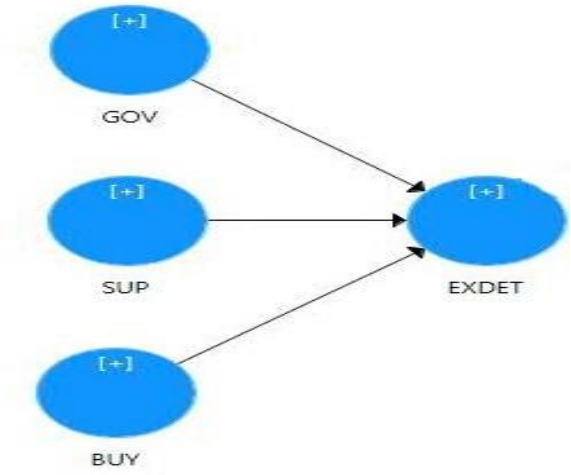

Figure 5.17: EXDET construct at second-order construct level

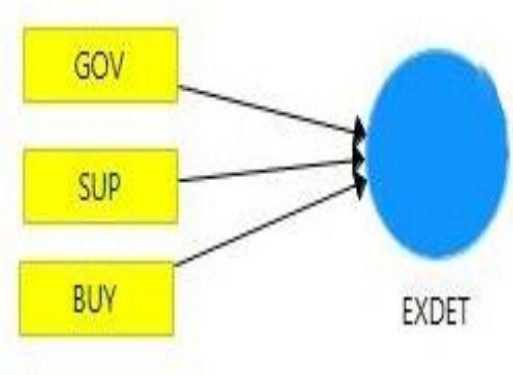

Figure 5.18: Replacing latent variable for EXDET construct

5.4.2 Assessment of the structural model

In this stage, the structural model was assessed in relation to the analysis of the hypothesised relationships between the latent constructs (Santosa, Wei, and Chan 2005, p. 367). The structural assessment process encompassed significant evaluation steps comprising: appraising the explanatory power of the independent variables (R^2) and checking the direction of path loadings and the corresponding values of *t*-statistics (Barclay, Higgins, and Thompson, 1995, p. 299; Santosa, Wei, and Chan,

2005, p. 366). To analyse the data in this study, the bootstrapping method was chosen (Chin, 1998a).

5.4.2.1 Path coefficient (β) and statistical significance of t-value

Two valuable tests for assessing hypothesised relationships are path coefficients and corresponding *t*-values, with reference to Hair, Ringle and Sarstedt (2011). Both of these tests are extracted from the bootstrapping procedures through implementing PLS (Gefen, Straub, and Boudreau, 2000, p. 18). Bootstrapping is a non-parametric test of significance that produces statistics to evaluate the significance of structural paths. The *t*-value test assesses relationships between constructs. Simply stated, assessing *t*-values shows whether or not relationships between constructs are significant. The path coefficient value also shows the relationships between the constructs. For example, a positive value for the path coefficient indicates a positive relationship between the constructs. Table 5.15 presents the result for the path coefficient (β) and the *t*-value for external determinants (EXDTs).

Table 5.15: Path coefficient (β) and *t*-value for external determinants

Hypothesis	Link	Path coefficient	*t*-Value	Outcome
H1	EXDET → GSCP	0.298	2.067	Supported
H2	INTD → GSCP	0.346	2.484	Supported
H3	EXDET → INTD	0.370	2.520	Supported
H4	EXDET → INTD → GSCP	Indirect effect *p*-value: 0.128; STDEV* = 0.08 accepted	1.607	Weakly supported
H5	GSCP → PE	0.460	3.491	Supported

Note*: STDEV = standard deviation

5.4.2.2 Amount of variance or R-squared (R^2)

The R^2 values evaluate the predictive power of the proposed research model (Barclay, Higgins, and Thompson, 1995, p. 299; Hair, Ringle, and Sarstedt, 2011). The R^2 values are provided by the bootstrapping method (Chin, 1998b, p. 302) and can predict the explanatory power of endogenous variables through displaying the amount of variance in the construct which is described by its corresponding independent constructs. Referring to Teo, Wei, and Benbasat (2003, p. 32), a R^2 value of 0.1 or above is acceptable. Table 5.16 presents the results of using PLS estimation by employing a bootstrapping test for the explanatory power of the endogenous constructs. Based on the result proposed in Table 5.16, all R^2 values were above the minimum cut-off value, in reference to Teo, Wei, and Benbasat (2003, p. 32); thus, the explanatory validity of the model is confirmed.

Based on the R^2 scores, as shown in Table 5.16, the SEM estimation further explained that 13.7% of the variance in the internal supply determinants (INTDs) was accounted for by external determinants (EXDETs). Internal supply determinants (INTDs) also affected the effectiveness of the GSCPs construct with a R^2 value of 28.4%. Finally, the model indicated the significant impact of green supply chain practices (GSCPs) on firm performance (PE) as 21.2% of variance in firm performance was accounted for by green supply chain practices (GSCPs).

Table 5.16: Explanatory power of endogenous (dependent) constructs

Endogenous (Dependent) Construct	***R²***
Internal supply determinants (INTDs)	13.7%
Green supply chain practices (GSCPs)	28.4%
Firm performance (PE)	21.2%

5.5 TESTS OF HYPOTHESES

In this section, the results of the four research hypotheses are described in detail. Table 5.17 presents the results of the research hypotheses, while Figure 5.19 depicts the comprehensive model estimate.

Hypothesis 1 (H1) was proposed to evaluate the influential effect of external determinants (EXDETs) on green supply chain practices (GSCPs). Thus, H1 was supported.

> ***H1: External determinants (EXDETs) have a direct and positive influence on green supply chain practices (GSCPs) in the Australian food industry***
> (β = 0.298, t = 2.067).

Hypothesis 2 (H2) was developed to assess the influence of internal supply determinants (INTDs) on green supply chain practices (GSCPs). The model estimation described a significant effect of internal supply determinants (INTDs) on green supply chain practices (GSCPs). Thus, H2 was supported.

> ***H2: Internal supply determinants (INTDs) have a direct and positive influence on green supply chain practices (GSCPs) in the Australian food industry***
> (β = 0.346, t =2.484, R^2 = 28.4%)

The hypothesised relationship between external determinants (EXDETs) and internal supply determinants (INTDs) was postulated in Hypothesis 3 (H3). External determinants (EXDETs) were found to have significant effects on internal supply determinants (INTDs). Thus, H3 was accepted.

> ***H3: External determinants (EXDETs) have a direct and positive influence on internal supply determinants (INTDs) in the Australian food industry***
> (β = 0.370, t = 2.520).

The indirect effect of external determinants (EXDETs) on green supply chain practices (GSCPs) through internal supply determinants (INTDs) was proposed in Hypothesis 4 (H4). The structural equation modelling (SEM) results presented a weak association between external determinants (EXDETs), internal supply determinants (INTDs) and green supply chain practices (GSCPs). Thus, H4 was accepted.

> ***H4: External determinants (EXDETs) have an indirect, positive but weak influence on green supply chain practices (GSCPs) through internal supply determinants (INTDs) in the Australian food industry***
> (indirect effect: p = 0.108, t = 1.607)

The effect of green supply chain practices (GSCPs) on firm performance (PE) was proposed in Hypothesis 5 (H5). The structural equation modelling (SEM) results

presented a significant association between green supply chain practices (GSCPs) and firm performance (PE). Thus, H5 was accepted.

H5: Green supply chain practices (GSCPs) have a direct and positive influence on firm performance (PE) in the Australian food industry
(β = 0.460, *t* = 3.491, R^2 = 22.1%)

Table 5.17: Results of hypotheses tests

Hypotheses	**Comments**
H1: External determinants (EXDETs) have a direct and positive influence on green supply chain practices (GSCPs)	Supported
H2: Internal supply determinants (INTDs) have a direct and positive influence on green supply chain practices (GSCPs)	Supported
H3: External determinants (EXDETs) have a direct and positive influence on internal supply determinants (INTDs)	Supported
H4: External determinants (EXDETs) have an indirect, positive but weak influence on green supply chain practices (GSCPs) through internal supply determinants (INTDs)	Weakly supported
H5: Green supply chain practices (GSCPs) have a direct and positive influence on firm performance (PE)	Supported

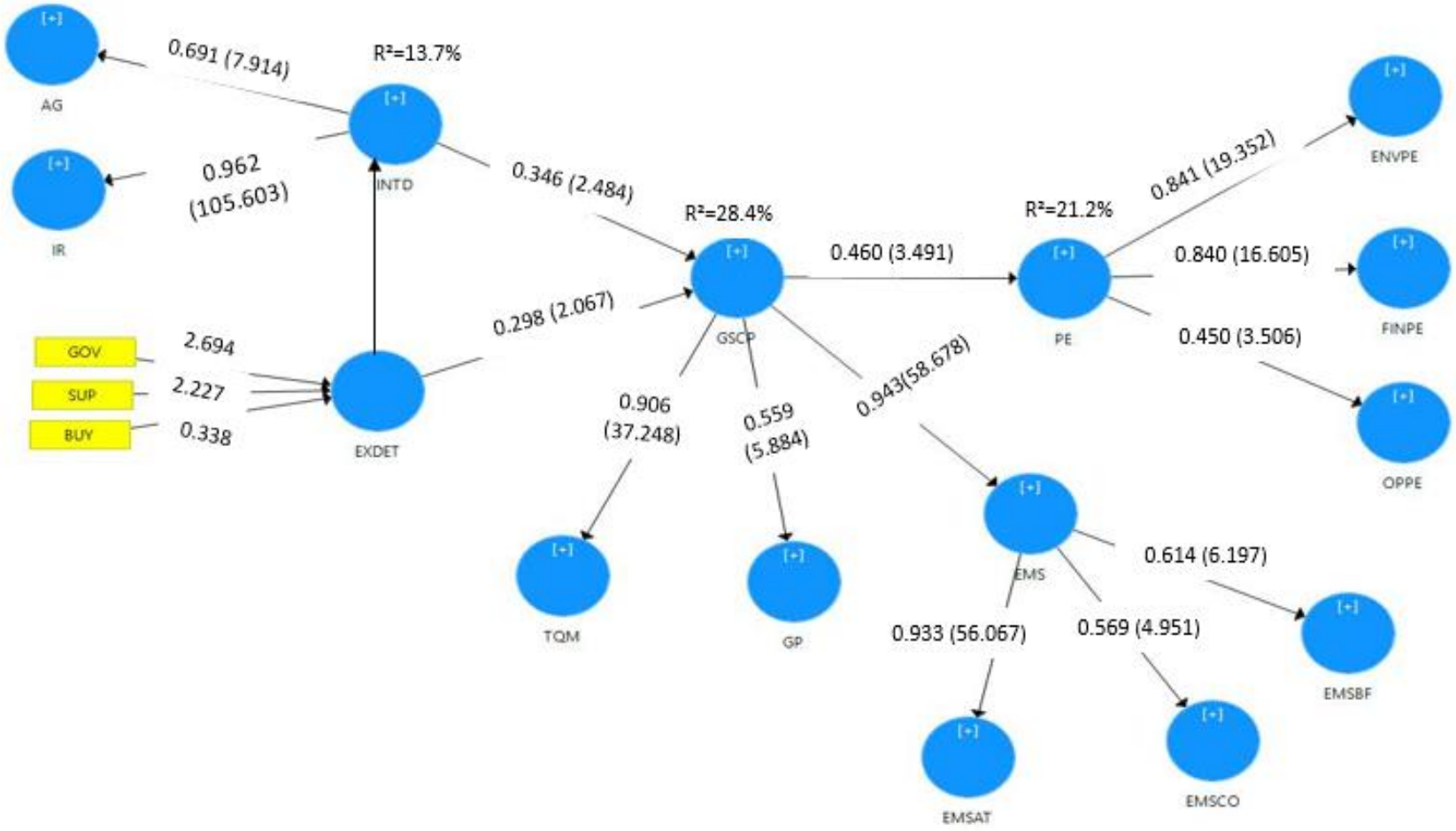

Figure 5.19: Comprehensive model estimate

5.6 DESCRIPTIVE ANALYSIS OF SAMPLE (FIRMS IN THE PROCESS OF IMPLEMENTING ENVIRONMENTAL MANAGEMENT SYSTEMS [EMSs])

This section reports the demographic analysis of survey respondents from firms in the process of implementing environmental management systems (EMSs). In this group of firms, 21 respondents completed the questionnaire. As with the EMS-certified firms, in the demographic section, the information sought for analysis was as follows: the respondents' education; length of employment; position; number of employees in their firm; annual revenue of their firm; Australian state or territory of firm's location and product type produced by their firm. In addition, SPSS was used to rank the potential benefits of implementing an EMS by this group of firms. As with the EMS-certified firms, the values and measurement tools for analysing the demographic information of survey respondents were numeric and scales, respectively. The respondents' demographic information and the potential benefits of EMS implementation are presented in the following paragraphs.

5.6.1 Education

The education level of respondents is presented in this section. As shown in Table 5.18, most survey respondents (over 88.9%) had higher education comprising a university degree or a postgraduate university degree (61.1% and 27.8%, respectively). Only a few respondents (11.1%) had trade qualifications. Simply stated, the result indicated that most respondents had a high level of education in their respective industry.

5.6.2 Length of employment (work experience)

This section describes the length of respondents' employment, with Table 5.18 presenting the results in detail. No respondent had less than one year's experience. Most respondents (77.7%) were in two groups, 11–20 years and more than 21 years with 33.3% and 44.4%, respectively. Two groups (1–5 years and 6–10 years) had a similar proportion of respondents at 11.1%. As with the EMS-certified firms, this result emphasised that the survey questionnaires were completed by highly experienced people with complete familiarity with this specific industry.

5.6.3 Position

In this section, the employment position of respondents is presented, with further details in Table 5.18. Half of the respondents (50%) in this group held positions in quality and environmental management. A significant point is that two groups (CEO/Director and Engineering Manager) had a similar proportion of survey participation at 5.6%. In addition, 16.7% of respondents were General Managers while 11.1% of respondents were Business Managers. Moreover, 11.1% of respondents held managerial positions in different areas, such as new product development, financial, etc. Analysis of this information indicated that the managers responsible for environmental activities held different positions in their firms.

5.6.4 Number of employees (firm size)

Table 5.18 presents the number of employees in these firms in the process of EMS implementation where these respondents worked. It was established that most respondents (52.4%) worked in firms with 20–199 employees. The second highest proportion of respondents (42.9%) worked in firms with more than 200 employees. Only a few respondents (4.8%) worked in firms with 6–19 employees. This information showed that the research data were mainly collected from medium-sized and large firms.

5.6.5 Annual revenue

Table 5.18 presents the annual revenue of these firms in the process of EMS implementation. As shown in Table 5.18, the largest group of respondents (42.6%) indicated that their firm's annual revenue was more than A$5,000,001. In total, 23.9% of respondents indicated that their firm's annual revenue was between (A$500,001–A$1,000,000 and A$1,000,001–A$5,000,000). In contrast, only a few respondents (4.8%) claimed that their firm's annual revenue was in the range from A$250,001–A$500,000). This result confirmed Section 5.4.4's result which indicated that data were mainly collected from respondents working in medium-sized and large firms.

5.6.6 Respondents' Australian state or territory

Table 5.18 presents the geographic location of respondents' firms. Most respondents (76.2%) were from two states, VIC and NSW (42.9% and 33.3%, respectively). In total, 14.3% of respondents were from SA followed by 9.5% from QLD. This result confirmed that most food manufacturing firms were concentrated in the states mentioned above.

Table 5.18: Demographic information of survey respondents

Education	**No.**	**%**
High school	-	-
Trade qualification	2	11.1%
University degree	11	61.1%
Postgraduate university degree	5	27.8%
Work experience	**No.**	**%**
< 1 year	-	-
1–5 years	2	11.1%
6–10 years	2	11.1%
11–20 years	6	33.3%
> 21 years	8	44.4%
Position	**No.**	**%**
CEO–Director	1	5.6%
General manager – Planning	3	16.7%
Business Manager (Purchasing and Marketing Managers)	2	11.1%
Quality and Environmental Manager	9	50.0%
Supply Chain Manager	-	-
Area Manager	-	-
Engineering Manager (Operation, Manufacturing, Technical Managers)	1	5.6%
Other (*NPD, Financial ...)	2	11.1%
Number of employees	**No.**	**%**
< 5 employees	-	-
6–19 employees	1	4.8%
20–199 employees	11	52.4%
>200 employees	9	42.9%
Annual revenue	**No.**	**%**
< A$250,000	-	-
A$250,001–A$500,000	1	4.8%
A$500,001–A$1,000,000	2	9.55%
A$1,000,001–A$5,000,000	3	14.35%
> A$5,000,001	15	42.6%
State/territory	**No.**	**%**
ACT	-	-
NSW	7	33.3%
SA	3	14.3%

TAS	-	-
QLD	2	9.5%
VIC	9	42.%9
WA	-	-

*NPD: New Product Development

5.6.7 Product types

Table 5.19 shows that data were collected from respondents working across a variety of firms producing various types of food. In this section, as in Section 5.3.7, product frequency was reported. Most collected data were from the dairy industry with five respondents. Three groups: meat processing; poultry processing; and cereal food and baking mix manufacturing had the second highest number of respondents with three in each sector, followed by fruit and vegetable processing with two respondents. Also, results derived from SPSS revealed that a few respondents were from dissimilar sectors such as beer and malt manufacturing, ice cream manufacturing, fruit juice drink manufacturing, etc.

Table 5.19: Types of product

Product	***F**	**Product**	**F**
Meat Processing	3	Confectionery Manufacturing	1
Poultry Processing	3	Snack Food Manufacturing	1
Ice Cream Manufacturing	1	Beer and Malt Manufacturing	1
Dairy Product Manufacturing	5	Wine Manufacturing	1
Fruit and Vegetable Processing	2	Fruit Juice Drink Manufacturing	1
Cereal Food and Baking Mix Manufacturing	3	Other	5

*F = frequency

5.6.8 Benefits of implementing an EMS

The next step of this study's data analysis of firms in the process of implementing an EMS sought to provide descriptive statistics from the answers to 24 questions about the potential benefits of implementing an environmental management system (EMS). In this step, minimums, maximums, means and standard deviations were analysed for each benefit of EMS implementation. As shown in Table 5.20, all the items had a mean greater than 3. In particular, factors such as: preserving the environment; clean operation; improving social commitment; an EMS can assist top

management; recycling; improvement of corporate image; and reduction of solid/liquid waste each had a mean value of over 4 meaning that these factors were considered the most valuable reasons for EMS implementation. The coding of factors was described in detail in Chapter 4 (See Section 4.5).

Table 5.20: Benefits of implementing an EMS

	Descriptive Statistics				
Factors	N	Min	Max	Mean	Std. Deviation
BF1	21	3	5	4.24	0.625
BF2	21	3	5	4.14	0.478
BF3	21	4	5	4.14	0.359
BF4	21	3	5	4.10	0.539
BF5	21	3	5	4.05	0.498
BF6	21	3	5	4.00	0.775
BF7	21	3	5	4.00	0.447
BF8	21	3	5	3.90	0.436
BF9	21	2	5	3.90	0.700
BF10	21	2	5	3.86	0.793
BF11	21	3	5	3.86	0.573
BF12	21	2	5	3.86	0.727
BF13	21	2	5	3.62	0.973
BF14	21	2	5	3.52	0.750
BF15	21	2	5	3.48	0.814
BF16	21	2	5	3.43	0.811
BF17	21	2	5	3.38	0.805
BF18	21	2	4	3.38	0.590
BF19	21	2	5	3.33	0.856
BF20	21	2	5	3.29	0.644
BF21	21	2	4	3.19	0.680
BF22	21	2	5	3.05	0.740

5.7 DESCRIPTIVE ANALYSIS OF SAMPLE (FIRMS WITHOUT AN ESTABLISHED ENVIRONMENTAL MANAGEMENT SYSTEM [EMS])

This section presents the demographic analysis of respondents from firms without an environmental management system (EMS). From this group of firms, 63 respondents completed the questionnaire. As with the EMS-certified firms and firms in the process of implementing an EMS, demographic information was sought from respondents comprising: the respondent's education; length of employment; position; number of employees in their firm; annual revenue of their firm; Australian state or territory of their firm's location; and product type produced by their firm. Also, SPSS was used to rank the reasons why their firm was not interested in implementing an environmental

management system (EMS). As with the two previous groups of firms, the values and measurement tools for analysing the demographic information of survey respondents were numeric and scales, respectively. The following paragraphs present respondents' demographic information and the barriers they identified to implementing an environmental management system (EMS).

5.7.1 Education

Table 5.21 shows the respondents' level of education. Most survey respondents (76.4%) had higher education comprising a university degree or a postgraduate university degree (49.1% and 27.3%, respectively). In contrast, a few respondents (9.1%) had high school education and 14.5% of respondents had trade qualifications. Hence, this result indicated that most respondents had a high level of education in their respective industry.

5.7.2 Length of employment

Respondents were asked about the length of their employment to provide an indication of their level of experience in their respective industry which is shown in Table 5.21. The result revealed that the largest group of respondents (45.5%) had more than 21 years' experience while only 3.6% of respondents had less than one year's experience. A significant point is that two groups of respondents (1–5 years and 11–20 years) each had a similar proportion of respondents (21.8%). This result indicated that data were collected from highly experienced people in the food industry.

5.7.3 Position

Table 5.21 shows respondents' employment position in their food firms. The main groups of respondents, by their employment position, in this research were Quality and Environmental Managers (27.5%); Engineering Managers (19.6%); CEOs-Directors (17.6%); and General Managers (13.7%). A smaller group of respondents (5.9%) were Supply Chain Managers.

5.7.4 Number of employees (firm size)

Respondents were also asked about the number of employees in their firms with this information presented in Table 5.21. The largest group of respondents (41.9%) specified that their firm had 20–199 employees. The second largest group of respondents (33.9%) worked for firms with more than 200 employees. The smallest group of respondents (8.1%) stated that they worked in a firm with less than five employees. These results indicated that respondents to this study came from a good range of firms, based on the number of employees.

Table 5.21: Demographic information of survey respondents

Education	**No.**	**%**
High school	5	9.1
Trade qualification	8	14.5
University degree	27	49.1
Postgraduate university degree	15	27.3
Work experience	**No.**	**%**
< 1 year	2	3.6
1–5 year	12	21.8
6–10 years	4	7.3
11–20 years	12	21.8
> 21 years		45.5
Position	**No.**	**%**
CEO–Director	9	17.6
General Manager – Planning	7	13.7
Business Manager (Purchasing and Marketing Managers)	4	7.8
Quality and Environmental Manager	14	27.5
Supply Chain Manager	3	5.9
Area Manager	-	-
Engineering Manager (Operation, Manufacturing, Technical Managers)	10	19.6
Other (NPD, Financial ...)	4	7.8
Number of employees	**No.**	**%**
< 5 employees	5	8.1
6–19 employees	10	16.1
20–199 employees	26	41.9
> 200 employees	21	33.9
Annual revenue	**No.**	**%**
< A$250,000	1	1.7
A$250,001–A$500,000	5	8.5
A$500,001–A$1,000,000	7	11.9
A$1,000,001–A$5,000,000	9	15.3
> A$5,000,001	37	62.7

Australian state or territory	No.	%
ACT	1	1.6
NT	1	1.6
NSW	19	30.6
SA	12	19.4
TAS	2	3.2
QLD	5	8.1
VIC	12	19.4
WA	10	16.1

NPD*=New Product Development

5.7.5 Annual revenue

Respondents were also asked about the annual revenue of their firms, with the information presented in Table 5.21. Most of these respondents' firms (62.7%) had annual revenue of more than A$5,000,001. A few respondents (10.2%) were from two groups of firms with annual revenue less than A$5,000,000. This result confirmed the overall scenario of the Australian food industry as most participants were from NSW and VIC (see next section) and worked for large firms which had higher annual revenue.

5.7.6 Respondents' Australian state or territory

Table 5.21 presents the geographic location of these respondents' firms. Based on the information revealed through SPSS analysis, the largest group of respondents (30.6%) were from NSW. A similar proportion of respondents (19.4%) came from two states (VIC and SA). Likewise, a similar but smaller proportion (1.6%) was from each of the two territories (ACT and NT). This result confirmed that, in this study, data were collected from a variety of states and territories within Australia.

5.7.7 Product type

Table 5.22 shows that research data were collected from respondents working for food firms that produced various types of food. In this section, as in Sections 5.3.7 and 5.4.7, product frequency was reported. Most data were collected from respondents (n = 12) working in the dairy industry followed by those working in fruit and vegetable (n = 11). In total, 15 respondents worked in fruit juice drink manufacturing and confectionery manufacturing (n = 8 and n = 7, respectively).

Several other respondents worked in from various sectors such as oil and fat manufacturing, flour mill product manufacturing, ice cream manufacturing, etc.

Table 5.22: Types of product

Product	*F	Product	F
Meat Processing	5	Confectionery Manufacturing	7
Poultry Processing	4	Snack Food Manufacturing	5
Ice Cream Manufacturing	3	Beer and Malt Manufacturing	2
Dairy Product Manufacturing	12	Wine Manufacturing	1
Fruit and Vegetable Processing	11	Fruit Juice Drink Manufacturing	8
Oil and Fat Manufacturing	3	Flour Mill Product Manufacturing	3
Seafood Processing	4	Other	15
Cereal Food and Baking Mix Manufacturing	4		

*F = frequency

5.7.8 Barriers to implementing an EMS

The next data analysis for those firms that had not implemented an EMS was to provide the descriptive statistics and standard deviations for the 29 identified barriers to EMS implementation. In this stage, before proceeding to data analysis, all uncompleted responses were deleted, with 63 usable responses remaining from 69 responses for data analyses. The details of factor coding were also described in Chapter 4 (See Section 4.5).

In this step, minimums, maximums, means and standard deviations for each barrier to implementing an EMS were analysed. Table 5.23 presents the summary of these minimums, maximums, means and standard deviations. This table presents in detail all 29 measurement items on the barriers to implementing an EMS, based on respondents' responses. Table 5.23 presents the means of the factors with 'other priorities/investments' and 'current product meets customer requirements' each having a mean close to 4. Respondents thus identified these factors as the main reasons of not implementing an environmental management system (EMS). In contrast, two factors 'fear of failure in environmentally friendly project' and 'disbelief about environmental benefits' were considered as low in value as barriers to implementing an EMS, with means of 2.37 and 2.27, respectively.

Table 5.23: Barriers to implementing an EMS

Descriptive Statistics					
Factors	N	Min	Max	Mean	Std. Deviation
BAR1	63	2	5	3.92	0.885
BAR2	63	2	5	3.90	0.615
BAR3	63	2	5	3.63	0.848
BAR4	63	2	5	3.59	0.835
BAR5	63	2	5	3.52	0.913
BAR6	63	2	5	3.43	0.837
BAR7	63	2	5	3.41	0.873
BAR8	63	2	5	3.41	0.816
BAR9	63	2	5	3.30	1.026
BAR10	63	2	5	3.24	0.946
BAR11	63	2	5	3.22	0.706
BAR12	63	2	5	3.22	0.851
BAR13	63	2	5	3.19	0.800
BAR14	63	2	5	3.17	0.794
BAR15	63	2	5	3.17	0.871
BAR16	63	2	5	3.13	0.889
BAR17	63	2	5	3.11	0.918
BAR18	63	2	5	3.06	0.878
BAR19	63	1	5	2.92	1.082
BAR20	63	2	4	2.89	0.721
BAR21	63	1	4	2.37	0.789
BAR22	63	1	4	2.27	0.884

5.8 SUMMARY

This chapter has separately presented the data analysis for three groups of Australian food firms: environmental management system (EMS)-certified firms, firms in the process of implementing an environmental management system (EMS) and firms without an environmental management system (EMS).

For the first group of firms (EMS-certified firms), SPSS was firstly used to analyse respondents' demographic information. Secondly, the findings of the quantitative analysis of the survey conducted among food firm directors and managers were presented in detail. Based on the purpose of this research—understanding the comprehensive relationship between external determinants and internal supply determinants, green supply chain practices and firm performance—the researcher analysed 52 completed questionnaires from EMS-certified firms that were from two

groups of Australian food firms: the best 100 Australian food manufacturing firms and JAS-ANZ-certified food firms. The SmartPLS technique was then applied for data analysis for three significant reasons: the nature of the data (reflective and formative items); the nature of the study (exploratory study); and the small sample size.

The collected data were analysed using a two-stage assessment procedure: assessment of the measurement model and assessment of the structural model. Assessing the measurement model was done for two different types of construct—reflective and formative—in two levels: first order and second order. The measurement model assessment procedure for reflective constructs comprised establishing item reliability; internal consistency; average variance extracted (AVE) and discriminant validity also for both levels, first order and second order.

The procedures for the measurement of the formative constructs comprised determining their weighting and *t*-values, followed by employing latent variables for the second-run project. Assessment of the structural model was undertaken through three significant procedures: the establishment of the values for R^2 and path coefficients (β) and the significance of *t*-values. Based on SmartPLS results from analysis of the EMS-certified firms, the hypotheses developed in Chapter 4 were tested and evaluated. The implications of these results are discussed in Chapter 6. The above-mentioned process was carried out with the first group of firms (EMS-certified firms).

The second and third groups of firms for data analysis were firms in the process of implementing an EMS and firms without an EMS in place with 21 and 63 respondents, respectively. For firms in the process of implementing an EMS, SPSS analysed respondents' demographic information as well as their views of the potential benefits of implementing an environmental management system (EMS). Finally, in the third groups of firms (firms without an EMS), SPSS was used to analyse respondents' demographic information and the barriers identified by respondents for the lack of interest in EMS implementation.

CHAPTER 6

DISCUSSION AND IMPLICATIONS

6.1 INTRODUCTION

Chapters 4 and 5, respectively, presented the process of hypotheses development, the testing of hypotheses and the test results. The specific contribution of this study is the empirical validation, using SmartPLS structural equation modelling (SEM), of the relationships between green supply chain antecedents (external determinants [EXDETs] and internal supply determinants [INTDs]), green supply chain practices (GSCPs) and, in turn, firm performance (PE). The current chapter discusses the study's results through the lenses of statistical evidence and existing theories.

6.2 INTERPRETATION AND DISCUSSION OF DATA ANALYSIS RESULTS

6.2.1 H1: Hypothesis of external determinants to green supply chain practices

Hypothesis H1

This study investigated the relationship between external determinants (EXDETs) and green supply chain practices (GSCPs) which is aligned with Research Objective 1. It was anticipated that EXDETs would have direct and significant effects on GSCPs within the Australian food industry (β = 0.298, t = 2.067). Thus, incorporating EXDETs as an important determinant to develop GSCPs is logical and empirically valid. Also, any sort of change in EXDETs can impact on developing GSCPs in the Australian food industry. This finding was consistent with those of past studies (Nezakati et al., 2016; Zhao et al., 2017; Islam, Deegan and Gray, 2018; Lo and Shiah, 2016; Chiou et al., 2011; Roehrich, Hoejmose and Overland, 2017 and Ahmed, 2018).

As shown in the current study's results, incorporating EXDETs, comprising three dimensions: government, suppliers and buyers, to develop GSCPs is significant, logical and empirically valid. Based on the empirical findings, the government is a significant external dimension in GSCP development (Diabet and Govindan, 2011; Lin and Ho, 2011; Nezakati, Fereidouni and Rahman, 2016; Lo and Shiah, 2016). The research result shows that government can develop green practices through different

kinds of support, such as providing sufficient technological information and financial support (Scupola, 2003; Lin and Ho, 2011; Massoud et al., 2010; Zailani et al., 2011). The incorporation of buyers is another important external dimension in developing green supply chain practices (GSCPs). Based on the research findings, buyers' participation, as an external factor, has a significant role in developing GSCPs through activities, such as the firm's cooperation with buyers to develop environmentally friendly packaging, decreasing energy consumption during transportation and regularly meeting their future needs and expectations (Zhu et al., 2008; Green et al., 2012; Zhu et al., 2012). The other external dimension is the role of suppliers as an external determinant in developing green supply chain practices (GSCPs). Surprisingly, the research result did not confirm the role of this non-governmental stakeholder in developing green supply chain practices (GSCPs). The reason could be that firms are not regularly influenced by suppliers' activities. However, in the current study, the importance of the role of suppliers in other dimensions, namely, green purchasing and internal supply relationships (IRs) was proven. By the way, these results could be considered as a great opportunity for firms to require their suppliers to be more involved in environmental activities.

Overall, the results indicated that EXDETs played an important role in developing GSCPs in Australian food firms. These results are fundamentally in line with institutional theory for several reasons: firstly, they confirm the role of government support as an external factor that encourages firms to pursue and develop green practices. Secondly, they provide evidence of the importance of buyers' participation in GSCP development. Moreover, this research opens up a new view of the suppliers' side, highlighting that cooperation needs to be developed to improve green practices.

The research results have significant implications for Australian directors and managers in the food industry. They strongly confirm the critical supportive role of the government in developing green practices. It is therefore crucial that food firm directors and managers update their knowledge about government policy, consultant services, funds and incentives so they can successfully implement and develop green

practices. It is also essential for directors and managers in the Australian food industry to establish an appropriate relationship with government bodies. Australian food firm directors and managers must consider the role of buyers' participation in developing their green practices. The reason is that buyers' participation would help them to understand and meet buyers' environmental expectations. Furthermore, in the case of suppliers' participation, Australian food directors and managers need to be more involved with their suppliers through regular meetings, visiting sites and inviting them to their food firm's site as well as being more aware in their selection of suppliers. The major reason for developing these activities is to share resources and experiences, and to exchange them with the firm's capabilities to develop better environmental practices.

6.2.2 H2: Hypothesis of internal supply determinants to green supply chain practices

Hypothesis H2

The findings of this study corroborated a positive and direct relationship between internal supply determinants (INTDs) and GSCPs within the Australian food industry. The result also documented the association between INTDs and GSCPs, proving that INTDs are the significant internal antecedent for developing GSCPs (β = 0.346, t = 2.484) and explaining 28.4% of overall variance (R^2) in green supply chain practices (GSCPs). Thus, incorporating INTDs as an important determinant to develop GSCPs is logical and empirically valid. Also, any sort of change in INTDs can impact on GSCP development in the Australian food industry. This finding was consistent with those of past studies (Hoejmose et al., 2012; Mirghafoori et al., 2017; Sancha et al., 2016; Pagell and Shevchenko, 2014; Jabbour and de Sousa Jabbour, 2016).

The two significant dimensions, namely, agility (AG) and internal supply relationships (IRs) which comprise INTDS are built into the research findings, showing that incorporating both these dimensions to develop GSCPs is significant, logical and empirically valid. The result shows that agility (AG) is an important dimension of INTDs in developing green supply chain practices (GSCPs). As shown in the research result, agility (AG) is an essential component in contemporary business in effectively

developing GSCPs (Fernando and Saththasivam, 2017) through its valuable elements such as: flexibility in managing relationships with suppliers, technical competency to develop environmentally friendly practices and the ability to adjust relationships to cope with changing circumstances (Sharifi and Zhang, 2000; Mirghafoori et al., 2017). Simply stated, by considering agility's capabilities, firms can decrease the risk and speed up innovations in terms of green innovation (Ahmed et al., 2014). Therefore, firms need to pay more attention to agility (AG) in conducting appropriate planning to quickly respond to upcoming environmental standards, to more easily adopt new environmental technology and to develop their purchasing functions (Fernando and Saththasivam, 2017; Jin, Wang and Palaniappan, 2005).

Another important INTD for developing GSCPs is internal supply relationships (IRs) (Hoejmose et al., 2012; Ghozali Hassan et al., 2016). The research results indicated that internal supply relationships (IRs) improved GSCPs through elements such as developing communications between firm and their suppliers, undertaking evaluation and improving environmentally friendly products/services and capabilities to help each other regarding improving environmentally friendly practices (Ganesan, 1994; Morgan and Hunt, 1994).

Overall, the results emphasised that INTDs play an important role in the implementation and development of GSCPs by Australian food firms. The study finding is fundamentally in line with the resource-based view (RBV) as INTDs (e.g., cooperation, trust, commitment, etc.) are known as critical intangible resources for firms and their supply chains in effectively enhancing their green supply chain practices (GSCPs). Therefore, based on the results, firstly, the effective role of agility (AG) as an INTD in developing GSCPs is confirmed. Secondly, the importance of internal supply relationships (IRs) in terms of commitment to and cooperation in the development of GSCPs is supported by evidence.

The research results have several significant implications for Australian food firm directors and managers who are interested in being involved in green supply internal supply determinants. It shows that Australian food directors and managers need to

consider significant factors such as establishing appropriate communication and developing evaluation programs with their suppliers, and implementing agility (AG) to be fast to adopt and develop technical competency to take advantage of what GSCPs can offer. Australian food directors and managers also need to appreciate that several activities, such as substitution of purchasing materials with non-hazardous materials, using environmentally friendly packaging and implementing environmental and quality standards require the establishment of good relationships between supply chain partners. To develop environmental practices with supply chain partners requires better communication and flexibility to build long-term value based on good relationships with them. In other words, INTDS are considered as prerequisites for developing GSCPs requiring Australian food directors and managers to place specific attention on these determinants.

6.2.3 H3: Hypothesis of external determinants to internal supply determinants

Hypothesis H3

These finding indicated a significant positive direct association between EXDETs and INTDs within Australian food manufacturers (β = 0.370, t = 2.520). Thus, incorporating EXDETs to develop INTDs is logical and empirically valid. This means that any sort of change in EXDETs can impact on INTDs in the Australian food industry. This finding was consistent with the past study by Geffen and Rothenberg (2000). Findings of the current study show that EXDETs can increase INTD effectiveness. For example, increased support from the government can build up agility (AG) and flexibility, developing innovation to create green practices.

This study's results can be very useful for the Australian food industry. Australian food firm directors and managers should update their information about government policies and the variety of government support available. In addition, they need to develop participation by their buyers to be sufficiently agile to appropriately meet environmental requirements. Overall, Australian food directors and managers must develop their relationships with government bodies to better understand new environmental innovations, attending training courses and using consulting facilities to rapidly respond to the market's environmental expectations. It needs to be noted

that buyers' participation and feedback assist firms by providing the impetus for innovation and can encourage suppliers to develop environmental initiatives following the establishment of better relationships with their supply chain partners (Lee and Klassen, 2008).

6.2.4 H4: Hypothesis of mediation role of internal supply determinants between external determinants and green supply chain practices

Hypothesis H4

The findings indicated a positive but weak association between EXDETs developing GSCPs through the mediation role of INTDs within the Australian food industry (indirect effect: *p*-value = 0.108; β = 1.607). Incorporating EXDETs to develop GSCPs through INTDs is thus found to be logical and empirically valid. The research result infers that EXDETs, in terms of government support and buyers' participation, can develop GSCPs indirectly through agility (AG) and by establishing appropriate internal supply relationships (IRs).

This result is very useful for the Australian food industry. Australian food firm directors and managers need to understand the extent of external support from government and non-government bodies for developing INTDs based on intangible capabilities. These capabilities are composed of long-term relationships with the sharing of knowledge and experience, and the elements of speed and flexibility to decrease the risks when adopting environmental innovations in relation to GSCP development.

6.2.5 H5: Hypothesis of green supply chain practices to firm performance

Hypothesis H5

The findings of this study provide evidence that a positive relationship exists between green supply chain practices (GSCPs) and firm performance (PE). This was shown by the coefficient of association between GSCP and PE (β = 0.460), the corresponding t-value (t = 3.491) and the R2 value (R^2 = 21.2%) which indicated that GSCPs and PE had a significant positive relationship. It means that any sort of change in GSCPs can impact on firm performance (PE). This finding was consistent with those of past studies (Foo et al., 2018; Geng, Mansouri and Aktas, 2017; Lee, 2008; Ali et al., 2017; Longoni and Cagliano, 2018)

To understand the influential role of GSCPs on developing firm performances (PE), it is essential to consider several dimensions of GSCPs and dissimilar dimensions of firm performance (PE). In this study, GSCPs were composed of three significant dimensions: green purchasing, environmental management system (EMS) and total quality management (TQM), with the incorporation of these three dimensions built into the research finding on the development of PE found to be significant, logical and empirically valid:

- Firstly, the empirical findings confirmed the absolute importance of green purchasing for GSCPs among Australian food firms which is consistent with previous studies (Green et al., 2012; Zhu, Sarkis and Lai, 2008; Lee, Kim and Choi, 2012; Sharma, Chandra and Bhardwaj, 2015; Zhu et al., 2017). The research analysis shows that green purchasing, based on several significant factors, namely, collaboration with suppliers to develop environmental objectives; using environmental and technical standards for the purchase of raw materials; and providing design specifications to suppliers, is known as a significant GSCP dimension for developing firm performance (Green et al., 2012 and Zhu, Sarkis and Lai, 2008;).
- Secondly, the empirical findings confirmed that TQM is a significant dimension of GSCP through its valuable factors: strong commitment to environmental protection; continuous environmental improvement; and

benchmarking, with this being consistent with previous studies (Zhu and Sarkis, 2004; Hervani, Helm and Sarkis, 2005; Bag, Anand and Pandey, 2017; Sharma, Chandra and Bhardwaj, 2015).

- Thirdly, based on the result, incorporating an EMS as an important dimension of GSCPs is logical and empirically valid which is consistent with previous studies (Testa and Iraldo, 2010; Sharma, Chandra and Bhardwaj, 2015; Ahmed and Najmi, 2018). The research finding indicated a significant relationship between an EMS and GSCPs among Australian food firms for: developing competitive advantage; establishing better relationships with stakeholders; preserving the environment; increasing the motivation of personnel; and improving social commitment. The above points have confirmed that EMSs, TQM and green purchasing are significant measurements of GSCPs for developing firm performance.

As mentioned earlier, GSCPs significantly develop firm performance. In this study, the construct 'firm performance (PE)' comprised three dimensions: operational, financial and environmental performance. According to the research findings, incorporating environmental performance, financial performance and operational performance as significant dimensions of firm performance is logical and empirically valid. In the following sections, the relationship between firm performance and its dimensions are detailed:

- The findings of this study provided evidence that operational performance, in terms of producing a high-quality product and a variety of product lines as well as on-time delivery and lower inventory level, is a significant dimension of firm performance (PE) and its incorporation within that construct is logical and empirically valid, with this being consistent with previous studies (Green et al., 2012; Yu et al., 2014).
- The empirical findings of this research also confirmed that environmental performance, in terms of the production process producing fewer emissions into the air, consuming less water and producing less solid waste, is a significant dimension of firm performance (PE), with this being consistent with the findings

of (Green et al., 2012; Zhu, Sarkis and Lai, 2007; Dubey, Gunasekaran and Samar, 2015). Overall, this result infers that proactive activities towards environmental initiatives can effectively assist firms to not only mitigate the risk emerging from environmental issues but also improve environmental performance.

- Moreover, the empirical findings confirmed the importance of financial performance as a significant dimension of firm performance, with this being consistent with the findings of researchers (e.g., Masadeh et al., 2017; Green et al., 2012; Zhu, Sarkis and Lai, 2007). Based on the research result, financial performance is considered essential for controlling the high cost of implementing GSCPs via lower fees for waste discharge and waste treatment.

Overall, the current study demonstrated that green supply chain (GSC), through its valuable measurements, can improve various aspects of firm performance in the Australian food industry. Therefore, directors and managers in the Australian food industry must incorporate the above-mentioned practices in designing their firm's strategy and policy to ensure firm performance (PE). Australian food firm managers and directors must also develop and implement green initiatives through their supply chain to achieve successful supply chain performance. In this regard, they need to design a comprehensive program which covers valuable activities such as: training, site visits, monitoring and benchmarking to successfully implement environmental practices throughout their firm and its supply chain to achieve outstanding firm performance outcomes.

6.3 ANSWERING THE RESEARCH QUESTIONS

After discussion and evaluation of the hypotheses, the findings as they correspond to three research questions are now comprehensively discussed.

6.3.1 Research Question 1

How do external determinants affect the development of green supply chain practices in the Australian food industry?

In conjunction with Research Objective 1, this study analysed the relationship between the multidimensional and hierarchical measurement constructs: external

determinants (EXDETS) and green supply chain practices (GSCPs). The findings affirmed that EXDETs have a positive impact on the development of GSCPs within the Australian food industry. In line with this result, directors and managers in the Australian food industry emphasised the positive role of various kinds of government support and incentives in GSCP development. It is therefore critical to consider important factors, such as developing good relationships and updating knowledge about government environmental policy by participating in training programs or requesting meetings or consultation services. Moreover, the research findings indicated that Australian food firm directors and managers need to consider the role of effective participation by buyers in developing environmental practices. For instance, transportation is an important issue for Australian food firm directors and managers due to the need to decrease energy consumption. In this regard, they must consider decreasing the distance travelled by preparing materials from the local area. Overall, this valuable information has emphasised the significant impact of EXDETs on the effectiveness of GSCPs in the Australian food industry.

6.3.2 Research Question 2

How do internal supply determinants affect the development of green supply chain practices in the Australian food industry?

Corresponding to Research Objective 2, this study analysed the relationship between the multidimensional and hierarchical constructs: internal supply determinants (INTDs) and green supply chain practices (GSCPs). The findings from the theoretical conceptualisation supported the positive impact of INTDs on the development of GSCPs within the Australian food industry. This research provides valuable information for Australian food firm directors and managers. The research result shows that the directors and managers in the Australian food industry confirmed the significant impact of INTDs, in terms of internal supply relationships (IRs) and agility (AG), in the development of green practices. According to the findings, Australian food firm directors and managers emphasised the importance of agility (AG) (e.g., flexibility in relationships and developing technical competency) and internal supply relationships (IRs) (e.g., improving communication, developing capabilities to help each other and increasing evaluation programs) as valuable dimensions in INTDs for

improving green supply chain practices (GSCPs). Overall, the research findings indicated that effective INTDs are the prerequisites for adopting and developing purchasing policy, environmental system standards and quality procedures.

6.3.3 Research Question 3

How do external determinants impact on internal supply determinants in the Australian food industry?

In response to Research Objective 3, this study analysed the relationship between the multidimensional and hierarchical measurement constructs: external determinants (EXDETs) and internal supply determinants (INTDs). The findings from the theoretical conceptualisation supported the positive impact of EXDETs on INTDs within the Australian food industry. The result provides valuable information for Australian food firm directors and managers. According to the findings, the Australian food firm directors and managers confirmed that EXDETs (in terms of government support and buyers' participation) definitely develop INTDs in respect to agility (AG) and internal supply relationships (IRs). For example, developing environmental participation among buyers and participating in long-term partnership programs can definitely develop better communication followed by evaluation programs in firms' supply chains. Also, in reference to Australian food firm directors and managers, EXDETs, in terms of government support including financial or non-financial support, can develop the agility (AG) of firms/supply chains. Hence, the above-mentioned points have confirmed the significant impact of EXDETs on INTDs in the Australian food industry.

6.3.4 Research Question 4

How do external determinants impact on green supply chain practices through internal supply determinants in the Australian food industry?

According to the conceptual framework, the link between EXDETs and GSCPs is mediated by internal supply determinants (INTDs). The research findings then explained that EXDETs moderately impact on GSCPs through internal supply determinants (INTDs). In other words, EXDETs have a positive, partial and indirect impact on GSCPs via internal supply determinants (INTDs). As mentioned above in

response to Research Question 3, the Australian food firm directors and managers confirmed the significant role of EXDETs, in terms of government and buyers' participation, on INTDs, in respect to agility (AG) and internal supply relationships (IRs). Following the previous section (Research Question 3) about the influential role of EXDETs through developing government support and buyers' participation to develop agility (AG) and internal supply relationships (IRs), the current section emphasises that this relationship provides a suitable situation in which firms/supply chains can accept and adopt new technology and standards in terms of green practices. For example, according to the research result, developing buyers' participation and participating in long-term partnership programs can develop communication, followed by evaluation programs to establish an appropriate purchasing policy and expand the environmental and quality philosophy. Hence, understanding the relationship between EXDETs and INTDs is important in terms of GSCP development. If Australian food firms' directors and managers do not focus attention on this relationship, they will not achieve successful green supply chain practices (GSCPs). Overall, based on the research result, the Australian food firm directors and managers confirmed that EXDETs positively impact on GSCPs either directly and indirectly. This indirect approach, analysed via a multidimensional framework, is a novel method by which to examine the relationship between green supply chain antecedents and green supply chain practices (GSCPs).

6.3.5 Research Question 5

How do green supply chain practices improve the performance of Australian food firms?

In conjunction with Research Objective 5, this study endeavoured to develop the multidimensional and hierarchical measurement construct to understand the relationship between GSCPs and firm performance (PE). This research finding confirmed the absolute importance of GSCPs in developing firm performance (PE). In this study, the influential role of GSCPs was thoroughly examined through investigating the effect of several important practices, namely, green purchasing, total quality management (TQM) and the environmental management system (EMS) on firm performance (PE), that is, environmental, operational and financial

performance. As confirmed by the Australian food firm directors and managers, GSCPs, such as establishing an EMS and developing green purchasing policy, result in increased benefits for their firms/supply chains which include decreased waste, less water consumption and reduced emissions into the air. In addition, the result absolutely confirmed that focusing more on the quality philosophy leads to achieving more benefits for firms, such as producing a variety of high-quality products and ensuring on-time delivery of products to their buyers. The Australian food firm directors and managers indicated that implementing GSCPs brings increased financial benefits to their firms, such as lower fees for waste discharge and waste treatment. Hence, based on the above-mentioned points, it is evident that GSCPs could significantly improve firm performance (PE) in the Australian food industry.

6.4 BENEFITS AND BARRIERS IN EMS IMPLEMENTATION

As discussed in the chapter (5), the second and third groups of food manufacturing firms included for data analysis were firms in the process of implementing an EMS and firm without an EMS with 21 and 63 respondents, respectively. Based on the SPSS analysis, (Chapter 5), the potential benefits of implementing an (EMS) for firms in the process of implementing EMS mainly are preserving the environment, clean operations, improving social commitment, cultivating environmental awareness within the firm, and recycling and improvement of corporate image. These key critical factors indicate that firms understand the importance of social responsibility and market sensitivity towards the environmental issues. Also, these results pointed out that firms understand the importance of developing the application of environmental standard for increasing the shareholder wealth.

The third group of firms (not EMS certified firms) allowed to gather insights on the main barriers associated with the implementation of EMS. SPSS analysis designated that the main barriers for not implementing EMS mainly are related to the other priorities of these firms; such as meeting customer requirements by current products, as well as insufficient incentives, lack of financial resources and government support. Based on these finding, support from government and professional institutions (e.g. training) would be important to educate the firms about the new market opportunities and enable them to develop the recruited capacity to implement EMS.

CHAPTER 7

CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

7.1 INTRODUCTION

Based on the extensive literature review, a comprehensive research model was developed and presented in Chapter 2 with the aim being to assess the relationship between constructs: external determinants (EXDETs) and internal supply determinants (INTDs) with green supply chain practices (GSCPs) and firm performance (PE) in the Australian food industry. In Chapter 3, the appropriate methodology (a quantitative study) and data analysis method (SmartPLS) were explained. In Chapter 4, the data obtained from a survey of directors and managers of Australian food firms and the research hypotheses were tested and analysed with SmartPLS software. In Chapter 5, the research findings were discussed, with it also shown that all five developed hypotheses were accepted. This concluding chapter provides a summary of the research including its significant theoretical and practical implications followed by presentation of the study's limitations. Finally, several avenues for future research are outlined.

7.2 SUMMARY OF RESEARCH FINDINGS

This research project was initiated to study the relationships between external determinants (EXDETs) and internal supply determinants (INTDs) and their impact on developing green supply chain practices (GSCPs) and, in turn, firm performance (PE). Previous studies have concentrated on the different aspects of GSCPs in dissimilar contexts and different countries, such as understanding the impacts of external determinants on GSCPs (Zhu et al., 2008; Nezakati et al., 2016 Wu et al., 2012; Lin and Ho, 2011; Lo and Shiah, 2016); the role of internal (organisational) determinants in GSCPs (Hoejmose et al., 2012; Gold et al., 2010; Simpson and Power, 2005); and the relationship between GSCPs and firm performance (Green et al., 2012; Zhu et al., 2008; Laosirihongthong et al., 2013; Testa and Iraldo, 2010).

The research results showed that a positive relationship existed between EXDETs and INTDs with GSCPs and firm performance (PE) in its environmental, economic and operational dimensions, with this being a unique contribution of the study. The research analysis also revealed that in the Australian food industry, GSCPs, that is, green purchasing, total quality management (TQM) and environmental management systems (EMSs) were positively influenced by EXDETs based on government support and buyers' participation as well as INTDs, namely, agility (AG) and internal supply relationships (IRs). The research results also showed that EXDETs had an indirect and positive but weak impact on GSCPs through internal supply determinants (INTDs). Finally, the research findings indicated that improving GSCPs resulted in better firm performance in terms of financial, environmental and operational aspects.

As discussed in Chapter 3, this study used a quantitative method under the positivist paradigm to test the research hypotheses. The quantitative research study conducted comprising survey instrument development, survey design, questionnaire review by expert academics and practitioners, data collection and data coding (as described in Chapter 5). To achieve greater reliability, the questionnaire was sent for feedback to expert practitioners, with modifications made and the final questionnaire distributed to Australian food firm directors and managers. Data were collected from two groups of firms: the best 100 Australian food manufacturing firms and food firms certified under the Joint Accreditation System of Australia and New Zealand (JAS-ANZ). Respondents were asked to send copies of the questionnaire to colleagues in other food firms. Of 345 distributed questionnaires, 146 responses were received; however, 10 uncompleted questionnaires were received and then withdrawn. A PLS-based structural equation modelling (SEM) technique was applied to analyse the collected data.

7.3 CONTRIBUTIONS OF THE RESEARCH

7.3.1 Theoretical contributions

The comprehensive research model in this study proposes to address significant issues in several theoretical areas in the GSCM domain. The significant research contributions relate to providing a better understanding of the relationships between

green supply chain (GSC) antecedents, including EXDETs as well as INTDs, and GSCP development by testing and validating these measurement constructs. The research also describes in detail the relationships between the GSCP construct and the firm performance (PE) construct. Building on the extensive literature review, several significant gaps were identified on GSC antecedents, GSCPs and firm performance (PE).

Based on the literature review, previous studies in the GSCM domain have tried to identify effective internal organisational determinants and their impact on green practices. However, studies about the relationship between INTDs and GSCPs are rare. Therefore, the current study has attempted to fill this gap by investigating the relationship between INTDs and green supply chain practices (GSCPs).

Also, few, if any, studies are available on the relationship between INTDs and EXDETs and how EXDETs can develop GSCPs through internal supply determinants (INTDs). In other words, investigation of the mediation role of INTDs in GSCP development is scarce.

Moreover, no previous research model has comprehensively investigated the relationship between EXDETs and INTDs with GSCPs and firm performance (PE). Hence, the current study attempted to fill this gap by presenting a valuable and new conceptual model which aimed to address the relationship between EXDETs and INTDs on GSCPs in the Australian food industry to ensure the effectiveness of firm performance (PE).

Furthermore, an empirically validated measurement for these multidimensional constructs has not been considered. Therefore, the current study has sought to thoroughly fill this gap by empirically validating the measurement of the multidimensional and hierarchical constructs: EXDETs, INTDs, GSCPs and firm performance (PE).

As discussed previously, this comprehensive research model is unique because it integrates two significant GSCM theories: the resource-based view (RBV) and institutional theory (IT) to describe the relevant EXDETs and INTDs and their relationships with green supply chain practices (GSCPs). Overall, this study extends the outcome perspective of the resource-based view (RBV) and institutional theory (IT) in the context of the Australian food industry and contributes significantly to the existing literature.

In summary, the research results reveal a positive relationship between EXDETs as well as INTDs on green supply chain practices (GSCPs). The research findings also confirm that EXDETs can positively (but weakly) develop GSCPs through internal supply determinants (INTDs). In addition, the results show that GSCPs in respect to TQM, EMS and green purchasing can positively develop firm performance (PE) in its economic, operational and environmental dimensions.

7.3.2 Practical contributions

From the practical perspective, this study has proposed a clear picture of how EXDETs and INTDs and their relationship can develop GSCPs followed by firm performance (PE) in the context of the Australian food industry. This study has several key implications for Australian food firm directors and managers.

Firstly, research findings revealed that EXDETs have positive and direct effects on green supply chain practices (GSCPs). This result means that the Australian food firm directors and managers responsible for environmental activities recognised that they need to consider the influential role of EXDETs if they want to develop GSCPs in their firms. For example, according to the research results, government support can assist in the development of green supply chain practices (GSCPs). This means that Australian food firm directors and managers need to establish good relationships with government bodies to develop their own knowledge about new environmental policy, financial support, incentives and tax benefits and they must demonstrate their compliance with government regulation.

Based on the research results, regularly meeting buyers' demands, and cooperation with buyers on environmentally friendly packaging as well as transportation due to energy consumption are known as three significant areas of buyers' environmental participation that must be carefully considered by Australian food firm directors and managers. To develop the knowledge of Australian food firm directors and managers about buyers' requirements, they must involve buyers in environmental activities and effectively utilise their participation.

Secondly, according to the research findings, INTDs positively impact on green supply chain practices (GSCPs). This result indicates that Australian food firm directors and managers must consider INTDs as valuable dimensions and manage them carefully in GSCP development. This study's findings demonstrated that agility (AG) factors such as flexibility in managing relationship with suppliers; adjustments to these relationships to cope with changing circumstances; and technical competence are three critical factors that must be carefully considered in GSCP development. In addition, the study found that internal supply relationships (IRs) in terms of the capabilities to help each other; implementation of better communication and development of evaluation programs can definitely develop GSCP implementation.

The current research makes another significant practical contribution to the Australian food firms that are in the process of GSCP implementation. According to the research findings, the implementation and development of green practices would develop firm performance (PE). Simply stated, the research findings illustrate the positive effect of implementing green practices, in respect to TQM, EMS and green purchasing, on developing firm performance (PE) in the dimensions of environmental, operational and economic performance. In other words, GSCPs, including EMSs (preserving the environment and increasing the motivation of personnel, etc); TQM (commitment, continuous improvement and benchmarking); green purchasing (considering technical standards for purchasing raw materials, design specifications and collaboration with suppliers) definitely can improve firm performance (PE). Overall, it is useful for Australian food firm directors and managers

to take note of these valuable findings in their firm's development of environmental practices and their firm's performance.

Based on the AFGC (2017), the Australian food industry plays a significant role in Australian industry in terms of the economy and employment. It is also a well-known industry based on its clean and safe products. It is therefore necessary for the Australian government and food firm directors and managers to take note of upcoming environmental innovations so they can meet buyers' environmental expectations to achieve excellent firm performance. The reason is that lack of attention to environmental practices has severe disadvantages for Australian food firms such as losing market share and weakening firm image. In summary, Australian food firm directors and managers can use this comprehensive model to refine their thinking about GSC antecedents, GSCPs and their effect on firm performance (PE). Other countries may also be interested in considering the findings of this research to plan their future strategies and policies: even comparing their perceptions with the study's findings may be of interest to them.

This study also has substantial implications for the Australian government and relevant bodies with respect to green issues of the Australian food supply chain. The government and other relevant bodies may undertake work to ensure health and safety issues are addressed and consider the establishment of more funds, incentives and tax benefits for green practices. Similarly, the government and other relevant bodies may also assist firms in improving GSCPs through supervising and monitoring and providing consultancy services.

7.4 RESEARCH LIMITATIONS

Research methods and designs each have their own limitations (McGrath and Kravitz, 1982). The current study also has some limitations which are described below:

Firstly, in this study, the only unit of analysis was Australian food manufacturers with the study's focus on the food manufacturing sector. Therefore, the relationships between GSC antecedents, GSCPs and firm performance (PE) have been mainly

analysed in the context of this industry and only among manufacturers. In other words, the opinions of stakeholders, such as buyers and suppliers, have not been considered.

Secondly, this study has mainly focused on understanding Australian food manufacturers' perspectives about the research variables in regard to suppliers and buyers. This means that, in the current study, only entities involved with the manufacturing operation are included, while buyers or customers are not considered for data collection.

Thirdly, in this study, the researcher used information that was derived only from previous literature studies, with no new link or construct emerging. Therefore, this issue is another limitation of the current study that must be considered in future research.

7.5 FUTURE REASERCH

This research generates numerous opportunities for future studies which can be summarised as follows: The domain of this research is focused on the food industry and the perishable products. Future research may be extended to the non-perishable sectors such as automobile or mining industries to explore the influence of different contexts. The current research was conducted in the Australian food industry but it can be extended to other regions of the world in order to explore how GDP, stage of development of the country, environmental awareness of business community, governmental mission and other socio-political factors in these regions impact the relationship between INTDs and green supply chain practices (GSCPs). This study investigated a variety of organisation's internal and external determinants in developing GSCP and their role in firms' performance. In addition, it is worth to consider the influence of implementing the environmental standard by firms on socio-political developments and GDP growth (gross domestic product) in the long-term industry forecast.

7.6 CONCLUSION

This study confirmed the significant impact of EXDETs and INTDs supported by two theories: institutional theory (IT) and the resource-based view (RBV) to develop green supply chain practices (GSCPs). The findings show that through factors, such as government support and buyers' participation, and INTDs, in respect to internal supply relationships (IRs) and agility (AG) can improve green supply chain practices (GSCPs). The research results also revealed that GSCPs, through several dimensions including TQM, EMS and green purchasing can improve dissimilar dimensions of firm performance (PE): environmental, economic and operational performance. Overall, the relationships between EXDETs, INTDs, GSCPs and firm performance (PE) produced the following results:

 External determinants were found to have positive and direct influences on green supply chain practices.
 External determinants were found to have positive and direct influences on internal supply determinants.
 Internal supply determinants were also shown to have direct positive effects on green supply chain practices.
 External determinants also have indirect positive but weak impact on green supply chain practices through internal supply determinants.
 Green supply chain practices have direct and positive impact on firm performance.

These results implied that the Australian food industry could manage EXDETs as well as INTDs to develop GSCPs and achieve outstanding firm performance (PE).

The study proposes several directions for future studies. It is suggested that future studies collect data from various industries and even conduct this study in other countries based on this comprehensive research model. Also, it is advised that future studies attempt to conduct field studies with qualitative data analysis to find new constructs or links to improve green practices. Moreover, it is suggested that future research work using this comprehensive research model should be across the separate entities of the supply chain.

Despite the research limitations described above, this study makes a significant contribution to both theory and practice. It presents a comprehensive research model for future GSCM research in terms of green antecedents, GSCPs and firm performance (PE). This study provides a better understanding of the determinant factors in the relationships of the EXDETs and INTDs with GSCPs and firm performance (PE).

APPENDICES

APPENDIX A: SURVEY QUESTIONNAIRE

Hello, my name is Azadeh R. Tabesh and I am a doctoral student at Marketing School, Curtin University, Perth. I am carrying out a study which is designed to understand the relationships between various factors that help to implement environmentally friendly practices by Australian food suppliers.

This research aims to improve knowledge of the regulatory, market, industry and organisational determinants of innovation in the Australian food industry. This study will target specific innovations in the food industry such as Total Quality Management (TQM), Environmental Management System (EMS) and Green Purchasing. The expected outcomes of this study would be clarification of factors that determine and limit innovation and implementation of environmentally friendly solutions in the Australian food industry. Successful implementation of environmental solutions will lead to a reduction of waste, increased environmental, operational and economic organisational performance of Australian food suppliers.

Please, be assured that the information that will be gathered from you will be kept confidential and used only for this research. Individual respondents will not be identified. Your participation in this survey is completely voluntary. Should you find it necessary, you may withdraw at any time.

This project has been approved by the Curtin University Ethics Committee Approved Number **RDBS-11-15**. If you require any additional information on this project, please contact Professor Mohammed Quaddus M.Quaddus@curtin.edu.au or Dr Bella Butler Bella.Butler@cbs.curtin.edu.au. Thank you for your collaboration.

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1. In which state or territory of Australia is your firm located? Please tick the appropriate response.

ACT	NT	NSW	SA	TAS	QLD	VIC	WA
☐	☐	☐	☐	☐	☐	☐	☐

In which segments of the food or beverage industry does your firm develop production activities, according to ANZSIC's four-digit classification code of the industry? Please tick the appropriate response/s

☐Manufacturing
☐Poultry Processing
☐Ice Cream Manufacturing
☐Dairy Product Manufacturing
☐Fruit and Vegetable Processing
☐Oil and Fat Manufacturing
☐Flour Mill Product Manufacturing
☐Cereal Food and Baking Mix Manufacturing
☐Bread Manufacturing
☐Confectionery Manufacturing
☐Seafood Processing
☐Snack Food Manufacturing
☐Beer and Malt Manufacturing
☐Wine Manufacturing
☐Fruit Juice Drink Manufacturing
☐Other (please mention)
Click here to enter text.

2. Based on the organisation's annual revenue, in which category does the firm belong? Please tick the appropriate response.

Less than 250,000	Between 250,001 to 500,000	Between 500,001 to 1,000,000	Between 1,000,001 to 5,000,000	Greater than 5,000,001
☐	☐	☐	☐	☐

3. How many employees does the firm have? Please tick the appropriate response.

Less than five persons	Between 6 and 19	Between 20 to 199	200 or more
☐	☐	☐	☐

4. What is your current position in the firm?

a. ☐ CEO
b. ☐ General manager
c. ☐ Business manager
d. ☐ Quality and environmental manager
e. ☐ Supply chain manager
f. ☐ Area manager

g. ☐ Engineering manager

e. ☐ Other (please mention) Click here to enter text.

5. How many years have you worked in food industry?

< 1 year	1 - 5 years	6 - 10 years	11 – 20 years	More than 21
☐	☐	☐	☐	☐

6. What is the highest level of education you have achieved?

High School	Trade Qualification	University Degree	Postgraduate University Degree
☐	☐	☐	☐

SECTION 2- GREEN SUPPLY CHAI PRACTICES

This section incorporated the measurement items with respect to green supply chain practices (GSCPs): EMS (Environment Management System), TQM (Total Quality Management) and GP (green purchasing).

7. Please select ONE of the following options and proceed as directed to the next question.

☐ Our firm **currently has an EMS** in place

Please answer to Question 8-10)

☐ Our firm currently is **in the process of introducing an EMS**

(Please answer to Question 11)

☐ Our firm **does not have an EMS** in place

(Please answer to Question 12)

- ***Questionnaire Section 2-A: Environment Management System***

8. Please tick each of the following statements with regards to the implementation of environmentally friendly practices in your firm such as waste reduction, emission reduction and water consumption. (Note: Very little extent =1; Little extent =2; Some extent =3; Great extent = 4; Very great extent =5)

		Very little extent				Very great extent
a.	To what extent does your firm pursue environmentally friendly practice?	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	To what extent are environmentally friendly practices highlighted in your firm vision?	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

c.	To what extent is your firm interested in implementing environmentally friendly practices?	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

9. Please answer each of the following statements by ticking a response where 1 is strongly disagree and 5 is strongly agree, with respect to your understanding about what constitutes an Environment Management System "EMS". (Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

		Strongly disagree				**Strongly agree**
a.	It needs a long time to get EMS certified	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	EMS will help our firm gain a competitive advantage over our competitors.	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
c.	EMS can assist top management to cultivate environmental awareness within the firm	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	The benefits of EMS outweigh the costs needed to implement the program in our organisation.	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

10. Please, answer each of the following statements by ticking a response where 1 is strongly disagree and 5 is strongly agree, with respect to the reasons and perceived benefits of implementing environmentally friendly practices. (Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

		Strongly disagree				**Strongly agree**
a.	Improvement of corporate image	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	Better relationship with stakeholders	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
c.	Preserving the environment	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	Increasing personnel motivation	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
e.	Quality improvement	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
f.	Improving social commitment	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

Please go to question 13.

- **Please answer to Question 11 if your firm currently is in the process of introducing an EMS**

11. On a scale of 1 to 5 where 1 is "Strongly Disagree" and 5 is "Strongly Agree", please indicate what benefits you believe the firm will gain by operating under an EMS.

Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5

		Strongly Disagree				**Strongly Agree**
a.	Preserving the environment	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	Clean operation	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

c.	An EMS can assist top management to cultivate environmental awareness within the firm	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	Recycling	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
e.	Improvement of corporate image	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
f.	Reduction of solid/liquid waste	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
g.	Reduction of emissions	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
h.	Quality improvement	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
i.	Better relationship with stakeholders	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
j.	Increasing opportunities to create competitive advantages	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
k.	Provides evidence of legal compliance	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
l.	Cost saving	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
m.	The benefits of EMS outweigh the costs	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
n.	Increasing support from government	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
o.	New market opportunities	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
p.	Improving sales	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
q.	Increasing personnel motivation	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
r.	An EMS will help our firm to gain a competitive advantage over our competitors.	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
s.	Gain new customers	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
t.	Improving profit margin	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
u.	Improving market share	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

Thanks for your participation

- **Please answer to Question 11 if your firm currently is in the process of introducing an EMS**

12. Please, answer each of the following statements by ticking a response where 1 is strongly disagree and 5 is strongly agree, with respect to the main barriers encountered in choosing not to implement or to abandon an existing Environment Management System. (Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

		Strongly disagree				**Strongly agree**
a.	Other priorities/investments were more important	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	Current product meets customer requirements	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

c.	Insufficient drivers or incentives	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	Lack of financial resources	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
e.	Lack of government support	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
f.	Lack of training	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
g.	Low awareness of environmental legislation	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
h.	High cost	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
i.	Lack of management commitment	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
j.	Insufficient technical expertise	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
k.	It takes a long time to be EMS-certified					
l.	Lack of firm environmental standards	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
m.	Reduced Return-on- Investments	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
n.	Lack of supplier commitment	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
o.	Lack of customer awareness	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
p.	Lack of new technology	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
q.	Implementing an EMS needs high investment	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
r.	Complexity in design to recycle the product	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
s.	Firm size of operation is too small	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
t.	Organisational resistance	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
u.	Fear of failure in environmentally friendly project	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
v.	Disbelief about the environmental benefits	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

Thanks for your participation

- ***Questionnaire Section 2-B: Total Quality Management***

13. **Please, answer each of the following statements where 1 is strongly disagree and 5 is strongly agree.** (Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

		Strongly disagree				**Strongly agree**
a.	We have a strong commitment to environment protection at all levels of our organisation	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	Continuous environmental improvement is an important factor in our firm	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	The supplies/ material that I received from the outside organisation meet my environmentally friendly goals	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
e.	We benchmark our environmental practice in our industry	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

f.	Our customers are highly important as a source of ideas for new products	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

Questionnaire Section 2-C: Green Purchasing

14. Please, answer each of the following statements by ticking your response in the scale from 1 to 5 where 1 is strongly disagree and 5 is strongly agree, with respect to the reasons for engaging and developing Green Purchasing in your firm. (Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

Note: *Green purchasing in food industry is related to the significant factors such as producing food (not grown with artificial fertilizers or pesticides), using biodegradable and recyclable packaging and cooperating with environmentally friendly suppliers. In regard to this explanation, please answer the below questions:*

		Strongly disagree				**Strongly agree**
a.	Our firm uses environmental and technical standards for purchasing raw materials	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	Our firm provides design specification to suppliers	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
c.	We require our supplier to have an approved certification	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	We collaborate with our suppliers for environmental objectives	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
e.	We audit suppliers' internal operations	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

SECTION 3 –EXTERNAL DETERMINANTS - RELATIONSHIP WITH SUPPLIERS AND BUYERS; LEGISLATION

15. Please answer each of the following statements by ticking a response where 1 is strongly disagree and 5 is strongly agree, with respect to the importance of the role of suppliers in the implementation of environmentally friendly practices. (Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

		Strongly disagree				**Strongly agree**
a.	We invite suppliers' personnel to our site to increase their awareness	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	We select our suppliers based on their environmental competencies	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
c.	Our firm requires suppliers to use environmentally friendly packaging (e.g., degradable and non-hazardous material)	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	We offer technical assistance to our suppliers	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
e.	We make site visits to suppliers to help them to improve their performance	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

16. Please answer each of the following statements by ticking a response where 1 is strongly disagree and 5 is strongly agree, with respect to the importance of the role of suppliers in the implementation of environmentally friendly practices .(Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

		Strongly disagree				**Strongly agree**
f.	Increasing support from government	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
g.	Appropriate source of finance	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
h.	sufficient information on technology	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

17. Please, answer each of the following by ticking your responses in the scale of 1 to 5 where 1 is strongly disagree and 5 is strongly agree, with respect to the importance of the role of buyers in improving environmentally friendly practises. (Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

		Strongly disagree				**Strongly agree**
a.	Our firm cooperates with customers to get their request about producing special products	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	We meet our customers' needs on a regular basis to find out what products they will need in future	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
c.	Our firm cooperates with customers for environmentally friendly packaging	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	Our firm cooperates with customers for using less energy during product transportation	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

Please go to section 4

SECTION 4 – INTERNAL SUPPLY DETERMINANTS- AGILITY AND INTERNAL RELATIONSHIPS

18. Please, answer each of the following statements by ticking your response where 1 is strongly disagree and 5 is strongly agree. (Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

		Strongly disagree				**Strongly agree**
a.	We can quickly accommodate requests for changes	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
g.	We are flexible in managing our relationship with suppliers	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
i.	Our firm has the technical competence to develop environmentally friendly practice	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
c.	In our partnership, we and our partner expect to be able to make	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

	adjustments in our relationship to cope with changing circumstances					

19. Please, answer each of the following by ticking your responses where 1 is very low existent and 5 is very high. (Note: Very low existent =1; Low existent =2; Moderate=3; High existent = 4; Very high =5)

		Very low existent				**Very high existent**
a.	The extend of mutual trust and respect with suppliers	**1☐**	**2 ☐**	**3☐**	**4☐**	**5☐**
b.	The extent of willingness to stay within the terms of the contract with our supplier	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
c.	The extent of capabilities to help one another regarding improving environmentally friendly practices	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	The extent of communications between our firm and our suppliers about environmentally friendly practices	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
e.	The extent of continually evaluating and improving the environmentally friendly products/services to meet our buyer requirement	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
f.	The extent of involving suppliers to environmentally friendly decision making	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

Please go to section 5

SECTION 5– FIRM PERFORMANCES

20. Please, answer each of the following statements by ticking your response where 1 is strongly disagree and 5 is strongly agree, to assess the impact of environmentally friendly initiatives on organisational performance: (Note: Strongly Disagree =1; Disagree =2; Neither agree nor disagree =3; Agree = 4; Strongly Agree =5)

		Strongly disagree				**Strongly agree**
a.	Our production process produces high quality product	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
b.	Our production process can produce a variety product lines	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
c.	Our production process delivers goods on time	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
d.	Our production process has lower inventory levels	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
e.	Our production process produces less emissions into the air	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
f.	Our production process consumes less water	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
g.	Our production process produces less solid wastes	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

h.	Our production process results in less energy consumption	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
i.	Our production process results in lower fees for waste discharge	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
j.	Our production process results in lower fees for waste treatment	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
k.	Our production process results in a reduction in fines for environmental accidents	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**
l.	Our production process has high operational cost	**1☐**	**2☐**	**3☐**	**4☐**	**5☐**

Thank you for your participation
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