# Drivers of Corporate Carbon Management Strategy (CMS) Adoption and Its Impact on Firm Performance: Australian Evidence

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# ABSTRACT

Recognising the enormity of carbon and climate change challenges to human and business entities (Stern, 2008; Garnaut, 2011), the view taken in this study is that carbon management plays a vital role in the transition to a low carbon future that is essential in gaining a competitive edge. The overarching objective of this thesis is to provide an in-depth understanding of the current status of carbon management strategy (CMS) adoption in the Australian context. In addition, this study seeks to examine the impact of internal organisational factors and stakeholder pressure in driving the adoption of different types of CMS. Finally, it analyses the relationships between firms' CMS adoption, financial performance and carbon performance.

A framework based on resource-based view (RBV), legitimacy theory and stakeholder theory provides the theoretical underpinnings for the thesis. The sample consists of Australia's top 200 publicly-listed firms for the period 2008 to 2012. This thesis has used two distinct phases: Phase 1 which is fully qualitative and Phase 2 which focuses on a quantitative method of analysis. Content analysis is used to collect data from Carbon Disclosure Project (CDP) survey, annual reports, sustainability reports and company websites.

This study recognises three types of CMS, ranging from the reactive 'compensation' strategy to more proactive 'reduction' and 'all-rounder' strategies. Evidence on the associations between stakeholder pressure, firm performance and CMS adoption is presented. The study finds that firms which adopt CMS are more likely to have an environmental management system (EMS), an environmental committee, larger boards and greater board independence. Furthermore, the results provide evidence that there are significant differences in stakeholder pressure for companies that adopt different types of CMS. Firms adopting reduction and all-rounder strategies are more likely to attach importance to primary and secondary stakeholder pressure whereas firms with compensation strategy adoption are less likely to attach importance to primary and secondary stakeholder pressure. Finally, the empirical analyses confirm that firms which adopt CMS are more likely to have better financial performance and carbon performance than firms without CMS adoption.

Overall findings of this thesis suggest that CMS adoption could provide the firm with a rare capability and therefore contribute to gain competitive advantage. In addition, the results indicate that internal organisational factors play a vital role in reducing the legitimacy gap through CMS adoption. Further the results confirm that firms adopt different types of CMS through the use of strategic resources to manage the many perspectives and conflicting interests of stakeholders. This thesis is important and useful to firms, policy makers and users as it provides an understanding of drivers and impact of CMS adoption, which are valuable for dealing with climate change.

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# CANDIDATE DECLARATION

I certify that this thesis:

- contains no material which has been accepted for the award to the candidate of any other degree or diploma, except where due reference is made in the text of the examinable outcome;
- to the best of the candidate's knowledge contains no material previously published or written by another person except where due reference is made in the text of the examinable outcome; and
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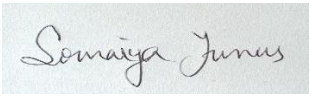

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# THESIS-RELATED RESEARCH OUTCOMES

**Published Paper**

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**Conference Papers**

Determinants of Carbon Management Strategy: Evidence from Australia's Top 200 Publicly Listed Firms, RMIT Accounting for Sustainability Conference, 2 June 2014.

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# CHAPTER 1

# OVERVIEW OF THE STUDY

## 1.1 INTRODUCTION

The purpose of this chapter is to provide an overview of the study. The chapter is structured as follows. Section 1.2 presents the background of the thesis. Research motivations and objectives are then discussed in Section 1.3. This is followed by the significance of the Australian context for research on carbon management strategy (CMS) adoption, and a summary of the conceptual framework in sections 1.4 and 1.5 respectively. Section 1.6 provides a brief description of the research methodology, and Section 1.7 then outlines the structure of the thesis. Finally, Section 1.8 summarises the chapter.

## 1.2 RESEARCH BACKGROUND

There has been overwhelming scientific evidence that climate change[1] presents serious global risks to humanity (Stern, 2008; Garnaut, 2011). The fifth Assessment Report of the Intergovernmental Panel on Climate Change (2012) has clearly stated that human interference with the climate system is increasing, and that climate change poses severe risks for human and natural systems. Scientific evidence emphasises the need to respond to the threats posed by climate change across businesses, industry and society (Intergovernmental Panel on Climate Change, 2011). It demands an urgent response – the costs of early actions will be lower than the potential catastrophic impact of climate change (Stern, 2008; Rankin, Windsor & Wahyuni, 2011).

[1] The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (United Nations Framework Convention on Climate Change, 1994, p.3).

Climate change experts have highlighted low-carbon energy strategies as a way of reducing carbon emissions (Stern, 2008). In a report on climate change (Intergovernmental Panel on Climate Change, 2012), it was stated that 85% of primary energy driving global economies is from the combustion of fossil fuels (i.e. gas, coal and oil). In addition, consumption of fossil fuels accounts for 56.6% of all anthropogenic greenhouse gas (GHG)[2] emissions; and carbon dioxide is by far the most significant of the GHGs, accounting for approximately 75% of these emissions (Intergovernmental Panel on Climate Change, 2012). To avert catastrophic climate change, it has been suggested that developed countries (which ratified the Kyoto Protocol[3]) need to commit to have reduced emissions between 80% and 90% from 1990 levels by 2050, starting with credible interim targets of 20% to 40% reduction by 2020 (Stern, 2008).

Extensive media coverage of global climate issues suggests that the real and possible effects of climate change on companies are increasing (Kolk & Pinkse, 2005; Lee, 2012). Furthermore, increasing pressure from regulators, the public, consumers and financial institutions have led many companies to address climate change as an integral aspect of their business and risk management strategy (West & Brereton, 2013). It is becoming clearer that failure to manage the impacts of a changing climate can expose companies to considerable risks (Linnenluecke, Birt & Griffiths, 2015). As the impacts of climate change become more apparent, companies need to decisively manage carbon emissions via CMS (Boston & Lempp, 2011).

CMS is "a firm's selection of the scope and level of its carbon management activity in response to climate change" (Lee, 2012, p. 34). Such responses include emission reduction commitments, process and supply improvements, product improvements, and new market and business development strategies that reduce carbon emissions. CMS enables a firm to identify its carbon emissions sources, measure emissions inventory, and explore alternative options to cut emissions levels (Wahyuni & Ratnatunga, 2015). As explained by the Environment Protection Authority (EPA) Victoria (2007), CMSs serve

[2] Anthropogenic GHGs pertain to gas emitted as a result of human activities. There are six GHGs that are monitored under the Kyoto Protocol: carbon dioxide; methane; nitrous oxide; hydrofluorocarbons; perfluorocarbons; and sulfur hexafluoride (United Nations Framework Convention on Climate Change, 1994, p. 3). Carbon is used synonymously with GHG throughout this thesis.

[3] The Kyoto Protocol is an amendment to the UNFCCC, an international treaty on global warming. The Protocol was adopted on 11 December 1997 in Kyoto, Japan, and entered into force on 16 February 2005. Countries which ratify this protocol commit to reduce their emissions of carbon dioxide and five other GHGs, or engage in emissions trading if they maintain or increase emissions of these gases. Currently, a total of 192 countries have ratified the agreement (United Nations Framework Convention on Climate Change, 2012).

two purposes: (1) to help companies[4] identify and assess approaches to reducing their carbon emissions; and (2) to provide a step-by-step framework that company can use to maximise environmental outcomes.

The growth in the academic interest on corporate climate strategy is related to the apparent shift in the position of corporate actors with respect to international action on climate change. Until the late 1990s, companies generally reacted via political and non-market[5] strategies mostly focused on corporate activities to shape climate change policymaking (Kolk & Pinkse, 2005; Jones & Levy, 2007). Around the early 2000s a transition has since taken place, from formerly viewing climate change as an exogenous corporate social responsibility (CSR) to incorporating it into strategic business management as an endogenous component of the whole business model (Hoffman, 2006; Maack & Skulason, 2006).

A range of market responses are now significantly contributing to companies' strategic positioning towards climate change (Kolk & Pinkse, 2005; Jones & Levy, 2007). Companies are starting to realise that by mitigating exposure to climate change risks, they can obtain a competitive advantage (Lash & Wellington, 2007; Porter & Reinhardt, 2007). Organisations are increasingly responding to climate-induced market shifts by undertaking a range of carbon management activities (Levy & Egan, 2003; Kolk & Pinkse, 2004, 2005). Yet such management of GHG emissions from a strategic perspective is a relatively new phenomenon. Thus, as the actual influences of climate change on firms have become more apparent, researchers have endeavoured to gain a better understanding of corporate carbon management activities in response to climate change (Kolk & Pinkse, 2005; Lee, 2012).

Previous studies have identified that awareness of climate change opportunities and threats is important for stimulating corporate action to manage carbon emissions (e.g. Berkhout, Hertin & Gann, 2006; Hoffmann, Trautmann & Hamprecht, 2009; Winn, Kirchgeorg, Griffiths, Linnenluecke & Günther, 2011). The obvious way for organisations to respond to climate change would be to take action aimed at substantially

[4] Firms, business, organisations and companies are used interchangeably in this thesis.
[5] Non-market strategy is a firm's 'concerted pattern of actions taken in the non-market environment to create value by improving its overall performance' (Baron, 1995, p. 48). It can be driven by government, media and social pressure and helps companies to gain competitive advantage.

reducing GHG emissions (Kates, 2000). Yet despite some relevant responses, organisational progress on a global scale has been slow.

Researchers and policymakers are therefore switching their attention to the development of specific climate change strategies that deliver initiatives to reduce organisational exposure and vulnerability (Dow et al., 2013). However, there is a dearth of research on the strategies companies have used to combat climate change in their decision-making processes. Thus, this study focuses on the different types of CMS adoption, and its drivers and impact on firm performance.

## 1.3 RESEARCH MOTIVATIONS AND OBJECTIVES

The main motivation for this study emerged from the concept that carbon management plays a key role in the transition to a low-carbon future (Wahyuni & Ratnatunga, 2015). As climate change policies, such as the Kyoto Protocol and the Emissions Trading Scheme (ETS) have evolved, previous literature has examined how businesses respond to climate change issues. However, accounting research on CMS adoption is still a relatively new endeavour. Prior studies (e.g. Hoffman, 2005; Kolk & Pinkse, 2005; Jeswani, Wehrmeyer & Mulugetta, 2008) have mostly emphasised firms' efforts to mitigate GHG emissions via production process, product improvement and supply chain measures, and their participation in emissions trading systems; and have highlighted the need to focus more on GHG emissions management (e.g. emissions reduction/elimination in the manufacturing process, design of less carbon-intensive products, and carbon emissions trading) in an accounting context (Boiral, 2006; Hoffman, 2007; Weinhofer & Hoffmann, 2010).

Thus, the first objective of this study is to provide an in-depth investigation of the current status of CMS adoption within organisations. Such focused analysis is important, as carbon emissions are fundamentally different from most other environmental issues, such as oil spills. That is, the impact of carbon emissions is global and irreversible, while the impact of most other environmental disasters is local and corrigible. Hence, carbon emissions are not specific to a particular region – they have the potential to impact every company, every sector and every country (Labatt & White, 2007; Wang, Li & Gao, 2013). They could also influence management's strategic choices and provide extra opportunities

for the company as well as additional business risks (Busch & Hoffmann, 2007). Examining management activities used to mitigate carbon emissions therefore provides deeper insights into how organisations resourcefully embark on the new paths by which their carbon-management-related capabilities are formed. Thus, exploring corporate CMS adoption is considered a contemporary and valid choice for this research.

Previous research suggests that corporate commitment to mitigating GHG emissions is influenced by a number of internal and external factors, ranging from stakeholder pressure to economic and social motives (Boiral, Henri & Talbot, 2012). Yet most of these studies have been limited to theoretical discussions (Dunn, 2002; Lash & Wellington, 2007; Nitin, Foster & Medalye, 2009) or to descriptions of the risks and opportunities that could result from addressing climate change (Schultz & Williamson, 2005; Porter & Reinhardt, 2007). Prior to this research there had been no study which empirically examined the impact of internal factors on corporate carbon strategy.

The second objective of this study is to examine the internal drivers of CMS adoption thereby uncovering new ways for companies to manage carbon emissions. Identifying such internal drivers will help companies to mitigate carbon emissions in the future and assist them in shaping relevant strategy, such as the most appropriate way to enter into new environmentally-friendly product markets.

Existing literature has suggested various practices organisations can use to reduce their impact on the environment and consequently improve their relationship with stakeholders (Shrivastava, 1995; González-Benito & González-Benito, 2005). Many of these practices have been grouped into the following: degree of environmental proactivity (control, prevention or proactivity) as proposed by Rusinko (2007); strategic, tactical or operational focus (Montabon, Sroufe & Narasimhan, 2007); or degree of collaboration with suppliers or customers (Vachon & Klassen, 2006; Vachon, 2007). Some other studies (Murillo-Luna, Garces-Ayerbe & Rivera-Torres, 2008; Sprengel & Busch, 2011) have shown that stakeholder pressures are perceived as one steady source of pressures[6], while others (Henriques & Sadorsky, 1999; Buysse & Verbeke, 2003) have derived multiple sets of stakeholders with only a subset actually influencing environmental strategy.

[6] Different types of stakeholder pressure are discussed in Chapter 3, Section 3.4.2.

Despite the apparent growth in stakeholder concern, and the widespread discourse in relation to corporate responsibility towards climate change, there is a lack of extant literature dealing with stakeholder pressure in relation to CMS adoption. This is therefore considered an interesting research avenue for three main reasons. First, firms are undoubtedly influenced by stakeholder pressure to mitigate carbon emissions (Sprengel & Busch, 2011). Second, as stakeholders apply different levels of pressure in terms of carbon emission management, and not all firms similarly respond to such pressures (Haque & Islam, 2015), companies that adopt CMS deal with different stakeholder groups according to stakeholder power, legitimacy and urgency (see Mitchell, Agle & Wood, 1997). Third, heightened stakeholder scrutiny is a vital factor which reflects a persistent aspect of stakeholder pressure (Perez-Batres, Doh, Miller & Pisani, 2012). That is, the more firms are subject to this kind of scrutiny, the more likely they are to respond to stakeholder pressure to mitigate carbon emissions. Hence, it is deemed as timely to undertake an empirical study on the adoption of CMS and its relationship to stakeholder pressure which is the third objective of this study.

With respect to firm performance, the fourth objective of this study is to examine the relationship between firms' CMS adoption, financial performance and carbon performance, which is motivated in two ways. First, scholars acknowledge the benefits to organisations of understanding their carbon footprints[7] and implementing CMS to address climate change (Downie & Stubbs, 2012; Lee, 2012; Pinkse & Busch, 2013). There is some evidence that pioneering firms of carbon reduction strategy already experience commercial benefits based on energy consumption reductions, minimised waste and reduced fuel usage from cutting down on travel (Okereke, 2007; Aguilera-Caracuel & Ortiz-de-Mandojana, 2013; Albertini, 2013). In addition, low-carbon products have offered new market opportunities and revenue streams (Pinkse & Busch, 2013). Second, how GHG emissions might impact on firm performance has been a heavy focus in academic literature, as these emissions often strongly influence the business environment and operations of most corporations (Busch & Hoffmann, 2011; Wang et al., 2013). Such analysis is significant because many companies are now undertaking firm-specific actions against climate change within the framework of a corporate climate strategy.

[7] A carbon footprint is historically defined as the total set of GHG emissions caused by an individual, event, organisation or product. It allows the assessment of the impact of carbon dioxide or its equivalent of other GHG emissions on global warming and thus contribution to climate change (Carbon Trust, 2009).

In view of these, the overarching objectives of this thesis are to provide an in-depth understanding of the current status of CMS adoption in the Australian context and identify the key factors that influence firms to adopt CMS. In addition, it examines how CMS adoption can be used as a strategic resource to gain a competitive edge and better performance. These objectives are therefore examined via the following research questions (RQs):

RQ1. What are the various types of CMS adopted by Australian Securities Exchange's (ASX) top 200 publicly-listed companies?

RQ2. Do internal organisational factors drive companies to adopt CMS in order to maintain legitimacy?

RQ3. Do companies' likelihood of adopting a given CMS depend on the pressure from certain groups of stakeholder?

RQ4. Do companies' CMS adoption relate to their financial as well as carbon performance?

## 1.4 SIGNIFICANCE OF THE AUSTRALIAN CONTEXT FOR RESEARCH ON CMS ADOPTION

This study is the first to examine the various CMSs adopted by ASX 200 firms. Thus, these findings will deliver insights on the general trends in CMS adoption among Australian firms, particularly those likely to be leaders in the areas of carbon emissions reduction, and corresponding stakeholder communication and corporate governance.

This study extends on climate change literature by providing empirical evidence on the drivers and motives behind CMS adoption and its impact on firm performance in Australia which has the highest per capita GHG emissions (Climate Change Authority, 2014). The Australian context provides a good setting for this research for several reasons. First, climate change has been a major issue in Australia since the beginning of the 21st century (New York Times, 2014). In 2013, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) released a report indicating that Australia is becoming warmer, and that it will experience more extreme heat and longer fire seasons because of climate change (ABC Online, 2014). Then in 2014, the Bureau of Meteorology (2014) reported on Australia's climate, highlighting several key effects including the dramatic increase in temperatures and the increasing frequency of bushfires, droughts and floods,

which have all been linked to climate change. Climate change is a global problem that poses serious risks to the Australian community, economy and environment; thus, effective policies that reduce Australia's emissions and support a global solution are in the country's best interests.

Second, the Australian Federal Government responded to environmental concerns at the global and local levels by ratifying the Kyoto Protocol in December 2007 (Commonwealth of Australia, 2007). The key aim of the Protocol is to reduce Australia's carbon emissions by 80% on 2000 levels by the year 2050, while rebalancing to a minimum of 20% renewable energy consumption by 2020 (Commonwealth of Australia, 2007). Australia's emissions over the period 2008–2012 averaged 104% of 1990 levels, less than its 108% target under the Kyoto Protocol. As a result, it has 116 metric ton carbon of emissions rights to carry over to its 2013–2020 Kyoto commitment. Even though it was a late signatory to the Kyoto Protocol, many Australian businesses have been carbon-conscious prior to signing the protocol in 2007 (Khoo, 2007). Various state-level carbon emissions policies were introduced well before the Kyoto Protocol was accepted at the national level (Ratnatunga, Wahyuni & Jones, 2012). For example, in 2003 the Australian state of New South Wales (NSW) introduced the Greenhouse Gas Abatement Scheme (GGAS) to incentivise electricity generators and retailers to reduce emissions associated with electricity production and consumption. This inspired other state schemes, such as the similar GGAS introduced by the Australian Capital Territory (ACT) in 2005, and the 13% Gas Scheme in Victoria in the same year (Sartor, 2010). Provisions on GHG measurement have also been introduced at the state level in Queensland, South Australia and Tasmania.

Third, effective from 1 July 2008, Australia's regulatory intervention for carbon emissions reduction came in the form of the *National Greenhouse and Energy Reporting Act 2007*[8] (*NGER Act 2007*). Designed as a precursor to an Australian emissions trading scheme (AETS), the *NGER Act 2007* enables firms to have an in-depth understanding of their climate change impact, in particular making high-emitting companies accountable

[8] Since 1 July 2008, the *NGER Act 2007* provides a mandatory GHG emissions reporting framework for organisations which meet a particular threshold. This threshold was initially set at 25 kilotons of CO2Es for corporations, and 125 kilotons for corporate groups, with further reductions in threshold levels for corporate groups planned for subsequent years (Clean Energy Regulator, 2012).

via public disclosure. As such, this Act has the potential to motivate firms to proactively identify areas of improvement in their internal systems and processes to mitigate their impact on climate change. In some ways, it facilitates CMS adoption and provides opportunities for Australian firms to maintain corporate legitimacy via transparent carbon disclosure.

In the midst of widespread public concern about the need to reduce carbon emissions in Australia, the subsequent years after the *NGER Act 2007* saw a number of failed attempts by the Australian Government to introduce a price on carbon. It was not until the *Clean Energy Act 2011*[9] was passed that a carbon pricing mechanism (CPM) was introduced. Accordingly, from 1 July 2012 a fixed carbon price of AUD$23 per ton of carbon dioxide equivalent (CO2E) was imposed by the national government on large Australian emitters for an initial period of three years (Clean Energy Regulator, 2013). The subsequent plan was to convert to an emissions trading scheme (ETS) from 1 July 2015. However, after much lobbying this carbon tax was abolished effective from 1 July 2014 (Clean Energy Regulator, 2013). The Australian Competition and Consumer Commission (ACCC) has since been given new powers to monitor prices and to sanction businesses that attempt to take unfair advantage of the carbon tax repeal.

The national government is currently revising Australia's climate policies by implementing a range of legislation to reduce GHG emissions. Australia needs these policies to drive reductions in domestic emissions, promote a steady transformation of the domestic economy, capture low-emissions growth opportunities, encourage innovation, and stimulate new low-emissions investment (Climate Change Authority, 2014). This aligns with a report by the Carbon Disclosure Project (CDP)[10] for Australia and New Zealand, which revealed that 89% of ASX 200 responding companies report greater integration of climate change into their business strategy (CDP Australia and New

[9] The *Clean Energy Act 2011* is the main act in a package of legislation that establishes an Australian ETS, to be preceded by a three-year period of fixed carbon pricing (known popularly as a carbon tax) designed to reduce carbon dioxide emissions and limit global warming. Pursuant to this act, a fixed price of AUD$23 per ton of CO2e was levied, with effect from 1 July 2012 (Clean Energy Regulator, 2013). It was intended to convert to a flexible, market-based mechanism from July 2015; however, the carbon pricing mechanism was abolished effective from July 2014.

[10] CDP is an independent not-for-profit global organisation working to drive GHG emissions reduction and sustainable water use by businesses and cities (Carbon Disclosure Project, 2012). It surveys companies through an annual questionnaire on the business implications of climate change, covering topics such as opportunities and risks of climate change for the company; emissions reduction strategies adopted; and technologies, products, processes or services the company develops or applies in response to climate change.

Zealand Report, 2012, p. 18). This finding confirms that companies are considering climate change and related carbon emissions alongside core business drivers.

Fourth, Australia is responsible for about 1.3% of the world's GHG emissions. While this may sound like a small proportion, Australia is the 15th highest emitter of GHGs out of 186 countries (Climate Change Authority, 2014, p. 69). This reflects Australia's relatively high share of fossil fuels in its energy supply. In 2011-2012, coal represented nearly 60% of Australia's total primary energy supply (Climate Change Authority, 2014, p. 69), compared with the Organisation for Economic Co-operation and Development (OECD)[11] average of 20% (Climate Change Authority, 2014, p. 69). Australia is one of only 19 countries that emit more than 1% of the world's GHG emissions. Furthermore, analysis of this world ranking indicates that Australia has the capacity to reduce these high emissions (Climate Change Authority, 2014). A steady transition will make it easier and less costly to reduce emissions, and will help improve Australia's long-term economic competitiveness in a more emissions-constrained world.

Thus, the Australian context offers a rich data source on how corporate entities are continuing to mitigate carbon emissions through CMS adoption, both to convey legitimacy and to respond to increasing societal concerns about climate change. Most importantly, this study focuses on how CMS adoption can be considered as a strategic resource that creates value for the firm by differentiating their activities from those of the competitors.

## 1.5 SUMMARY OF CONCEPTUAL FRAMEWORK

A framework based on resource-based view (RBV), legitimacy theory and stakeholder theory provides the theoretical underpinnings for this study. To understand how environmental strategy creates value for a firm, researchers often use RBV as a dominant theoretical paradigm (Hart, 1995; Sharma & Aragon-Correa, 2005). This view emphasises that internal resources and capabilities, when valuable, rare, inimitable and without equivalent substitutes, can lead to sustainable competitive advantage (Barney, 1991; Barney & Arikan, 2005). Corresponding proactive business strategies which include green practices and an environmentally-friendly approach to business operations are

[11] The OECD is an international organisation of countries with highly developed economies and democratic governments.

therefore often considered a valuable resource (Sharma & Vredenburg, 1998). Furthermore, legitimacy theory posits that an organisation exists to the extent that society considers it to be operating within the bounds of its licence to operate – that is, the 'social contract' (Dowling & Pfeffer, 1975; Deegan, 2002; O'Donovan, 2002). Organisational legitimacy provides critical social resources that facilitate and complement financial and physical resources. Based on a broader view of resources, legitimacy is integral and a valuable asset to firms (Barney, 1991; Hall, 1992). Thus, the legitimacy perspective complements RBV.

While legitimacy theory focuses on the expectations of society in general, stakeholder theory is concerned with the demands of particular groups within society, and the capacity of various stakeholders to pressure organisations to act in socially- and environmentally-responsive manners. Stakeholder theory is therefore closely aligned with legitimacy theory, and the two are often used to complement each other (Deegan, 2002). Stakeholder theory is premised on the notion that a company's continued existence depends upon the continuing support of its stakeholders; as such, the activities of the corporation must meet the stakeholders' expectations. Furthermore, to improve their competitive stance, companies need to manage the conflicting interests of their stakeholders, and thereby develop specific capabilities to manage these pressures (Rueda-Manzanares, Aragon-Correa & Sharma, 2008).

Thus, RBV, legitimacy theory and stakeholder theory see the organisation as part of a broader social system that influences and is influenced by the expectations of other parties within that social system. A joint consideration of these complementary theoretical perspectives is believed to provide a richer and more complete explanation of what motivates companies to adopt CMS and how it impacts on stakeholder pressure and firm performance in the context of a high-emitting country like Australia.

## 1.6 RESEARCH METHODOLOGY

The sample used in this study consists of the Standard and Poor's/Australian Stock Exchange's (S&P/ASX) top 200 publicly-listed firms. It examines panel data over a five-year period from 2008 to 2012, covering a period of mandatory disclosure of GHG emissions in Australia. The *NGER Act 2007* which mandates GHG emissions reporting

became effective from 2008, and the final year of the sample period marks the last reporting period before Australian firms were subjected to a carbon price as mandated in the *Clean Energy Act 2011*. The data for the analysis are taken from multiple sources of secondary data.

This thesis has used two distinct phases to investigate the RQs. Phase 1 is fully qualitative, using content analysis of CDP survey responses and other publicly-available information sourced from company websites, annual reports and standalone sustainability reports. The purpose here is to investigate the various CMSs adopted by Australia's top 200 ASX-listed firms. Drawing from prior relevant literature on climate change and CMS, a number of coding criteria were developed to identify Australian firms that adopt CMS.

Phase 2 focuses on quantitative method of analysis. The purpose of this phase is three-fold: (a) to examine the internal drivers of CMS adoption using logit estimation technique; (b) to explore if there are significant differences in stakeholder pressure for companies that adopt different types of CMS using probit estimation technique; and (c) to investigate the relationships between firms' CMS adoption, financial performance and carbon performance using the ordinary least squares (OLS) estimation technique.

## 1.7 STRUCTURE OF THE THESIS

The remainder of this thesis is structured as follows: Chapter 2 reviews the literature surrounding the three main theories – RBV, legitimacy theory and stakeholder theory – that underpin the theoretical framework of this thesis. This chapter also presents an overview of corporate CMS and discusses the motives behind environmental responsiveness in relation to Australia. This discussion further highlights the conceptual framework underpinning the research.

Chapter 3 provides a critical review of the academic literature related to climate change, CMS adoption, stakeholder pressure as well as firm performance. This discussion further highlights the gaps in the literature and helps in developing the hypotheses relating to this study's RQs.

Chapter 4 presents the empirical research design used to test the hypotheses in this study. It begins with a description of the sample and data sources, and then discusses

empirical models as well as corresponding estimation methods related to all the hypotheses tested to answer the RQs. The discussion is then extended to explain measures of the dependent variable, independent variables along with other firm-specific explanatory variables.

Chapter 5 discusses the findings of Phase 1, and presents the results of content analysis related to RQ1. The objective is to explore the various CMSs adopted by ASX 200 firms.

Chapter 6 documents the findings from the empirical analyses related to RQ2. The objective is to examine whether any significant relationship exists between a firm's adoption of CMS and various internal organisational factors such as the presence of an environmental management system (EMS), as well as corporate governance factors such as environmental committee status, board size and board independence.

Chapter 7 presents the findings from the empirical analyses related to RQ3. The objective is to explore if there are significant differences in stakeholder pressure for companies that adopt different CMSs.

Chapter 8 depicts the findings from the empirical analyses related to RQ4. The objective is to examine whether firms that adopt CMS experience better financial as well as carbon performance than firms that do not adopt CMS.

The above three chapters relating to empirical results (i.e. chapters 6, 7 and 8) discuss the findings from Phase 2. These chapters are configured in a consistent manner. The first section presents the descriptive statistics of the variables; the second sets out the correlation matrix; followed by a discussion of the results and the conducting of robustness tests. The final section of each of these empirical chapters presents a chapter summary.

The final chapter, Chapter 9, summarises the whole thesis. It provides the conclusion arrived at in relation to the main findings from the two phases of this study. The contributions and research implications of the findings are then examined. Finally,

the chapter ends with a discussion on this study's limitations and suggestions for future research.

## 1.8 CHAPTER SUMMARY

In this chapter, an overview of the study is presented. The chapter starts with the research background, motivations and objectives. The significance of the Australian context for this research on CMS adoption has also been discussed. This is followed by a summary of the conceptual framework used and a brief description of the chosen research methodology. Finally, the structure of the thesis is outlined. The next chapter provides the theoretical framework underpinning this research.

# CHAPTER 2

# THEORETICAL FRAMEWORK

## 2.1 INTRODUCTION

The purpose of this chapter is to review three dominant theories informing the framework used in this thesis to examine the drivers and motives behind CMS adoption and its impact on firm performance. The three theories are RBV, legitimacy theory and stakeholder theory. Section 2.2 provides an overview of corporate CMS. Then after discussing different types of CMS in Section 2.3, Section 2.4 presents the motives behind environmental responsiveness. This is followed by a discussion of the above three theories in sections 2.5, 2.6 and 2.7. The conceptual framework underpinning the research is then presented in Section 2.8, followed by a summarisation of the chapter in Section 2.9.

## 2.2 CORPORATE CMS – AN OVERVIEW

Carbon management generally refers to a firm's commitment to manage its GHG emissions across its business operations, which in turn facilitates the provision (disclosure) of corporate information on climate change (Kolk & Pinkse, 2007). In considering corporate CMS, various terms are used almost synonymously in the social and environmental accounting literature, such as business response to climate change (Jeswani et al., 2008), climate strategy (Kolk & Pinkse, 2005), corporate carbon strategy (Weinhofer & Hoffmann, 2010; Lee, 2012) and carbon management principles (EPA Victoria, 2007). As further examples, Weinhofer and Hoffmann (2010) defined carbon strategy as a pattern of activities undertaken to manage direct and indirect GHG emissions; while according to Kolk and Pinkse (2005) and Jeswani et al. (2008), climate strategy is a firm's choice among a number of strategic options in response to climate change. Lee (2012) defined corporate carbon strategy as the carbon management activities prioritised by a firm, and the amount of resources it allocates to these activities.

In contrast, Pinkse and Busch (2013) argued that firms follow a specific carbon norm, such as carbon neutrality or carbon labels, to show their commitment to climate change mitigation. They referred to carbon norms as an informal agreement shared across firms to constrain the use of carbon-based resources, which can also be perceived as an effort to strategically position the firm. That is, firms can utilise carbon norms to appeal to various stakeholders in different ways. For example, management can set and communicate new carbon norms to create a specific corporate image (Atvesson, 1990; Gioia, Schultz & Corley, 2000). Carbon norms can no doubt contribute to a competitive benefit if used as part of a differentiation strategy. Furthermore, the commercial advantages of aligning with carbon norms may put competitors under pressure to also commit to such standardisation.

EPA Victoria (2007) described carbon management principles as a means to facilitate the measurement of a firm's carbon emissions and its ability to implement mitigation strategies such as efficient use of energy, sourcing renewable energy, and offsetting residual GHG emissions to reduce its net greenhouse impact. Identifying the benefits of carbon measurement, it was the White Paper on the Commercial Value of Carbon Measurement (2010) that first introduced the concepts of corporate carbon management and measurement. This paper recommended that a comprehensive corporate CMS include carbon measurement, reporting, reduction, trading and other measures to mitigate climate-change-related risks. This would also foster opportunities to develop carbon-efficient products/services that enhance corporate competitiveness in a carbon-constrained marketplace.

Kolk and Pinkse (2005) were one of the first to examine strategic options available to firms for addressing climate change. They developed a typology based on the firm's strategic intent and its degree of interaction with other firms. Strategic intent varies between innovation and compensation, with innovation involving the development of new environmental technologies or services to reduce emissions. Compensation, in contrast, involves the transfer of emissions or emission-generating activities within the firm to other firms. That is, a firm may implement innovation or compensation internally within its own supply chain, and/or outside the supply chain through its interaction with its competitors or partner firms in different sectors. Strategic options for innovation include process improvement (at individual firm level), product development (at supply

chain level) and new product and/or market exploration (at beyond supply chain level). Strategic options for compensation includes the internal transfer of emissions (at individual firm level), acquisition of emissions credits through emissions trading, transferring activities as well as sources of high emissions to other parts of the supply chain (at supply chain level), and/or participation in offset projects (at beyond supply chain level).

In another study, Lee (2012) classified carbon management strategic activities into six categories: (1) emission reduction commitment; (2) product development; (3) process and supply improvement; (4) new market and business development; (5) organisational involvement; and (6) external relationship development. Table 2.1 provides an overview of these six main carbon management activities as defined by Lee (2012), linked in with the most relevant research and corresponding carbon management practices.

**Table 2.1: Main carbon management activities**

| Carbon management activity | Specific practices |
|---|---|
| Emission reduction commitment | • GHG reduction target-setting (Hoffman, 2005; Jeswani et al., 2008)<br>• Internal transfer of emission reduction (Kolk & Pinkse, 2005) |
| Product development | • Product development (Kolk & Pinkse, 2005)<br>• Designed-for-environment products (Boiral, 2006)<br>• Designing new products that emit less CO2, or improving existing products to be more carbon-free during their production and use (Weinhofer & Hoffmann, 2010) |
| Process and supply improvement | • Energy-efficiency enhancement (Dunn, 2002; Hoffman, 2005)<br>• Process improvement and supply chain measures (Kolk & Pinkse, 2005)<br>• Investment in plant retrofit projects and new plants (Schultz & Williamson, 2005)<br>• Better housekeeping, change in process technology, and GHG inventory (Jeswani et al., 2008)<br>• Developing new production processes that emit less CO2, or improving existing processes to be carbon-free (Weinhofer & Hoffmann, 2010) |
| New market and business development | • New market and product combinations (Kolk & Pinkse, 2005; Sprengel & Busch, 2011)<br>• Developing new products and technology solutions (Hoffman, 2005) |
| Organisational involvement | • Firms' awareness of opportunities for achieving energy efficiency and the impact of their activities on climate change, management involvement in climate change initiatives, and the encouragement of employees to take up initiatives (Jeswani et al., 2008) |
| External relationship development | • Emission trading and the clean development mechanism (CDM) (Dunn, 2002; Hoffman, 2005; Kolk & Pinkse, 2005; Schultz & Williamson, 2005; Boiral, 2006; Jeswani et al., 2008)<br>• Participation in voluntary programs (Jeswani et al., 2008) or in the political process (Hoffman, 2007; Sprengel & Busch, 2011)<br>• Making GHG data publicly available (Jeswani et al., 2008; Sprengel & Busch, 2011) |

Corporate responses to climate change are reminiscent of early models developed by firms to classify the firm's level of social and environmental commitment, ranging from a reactive to proactive stance (Clarkson, 1995). Henriques and Sadorsky (1999) asserted that the firm's actions with reference to environmental issues indicate their level of environmental commitment. In line with this, Winn and Angell (2000) developed a greening matrix that classifies firms according to their level of policy commitment and their approach in implementing corporate greening actions. According to this matrix, corporate responsiveness ranges from low commitment with passive/reactive initiatives to high commitment with active/proactive environmental strategies. Firms in the latter category are referred to as 'environmental innovators', while those in the former are considered 'environmental followers' (Winn & Angell, 2000).

Due to more recent pressures based on climate change, many companies have started to consider environmental issues within the context of their business activities. However, such environmental considerations, particularly in relation to the scope of business concerns, often are evaluated in light of several evolutionary stages of management (Molina-Azorin, Claver-Cortes, Lopez-Gamero & Tari, 2009). Jabbour and Santos (2006) identified three evolutionary stages based on the degree to which the environmental perspective is integrated within organisations. Functional specialisation is the first stage. At this level, firms do only what is necessary to react to the pressures of environmental regulation. For example, organisations incorporate regulatory equipment for pollution control without adequately modifying their processes or products. In this reactive stage, the company does not see the incorporation of environmental initiatives as a competitive advantage.

The second stage is internal integration of environmental management. At this stage, environmental management can influence some of the company's performance objectives, particularly those related to pollution prevention in response to regulations. That is, the environmental performance of the company is not yet treated as a competitive strength, and the environmental targets are generally established by management without staff participation. Even though such environmental awareness may contribute to some product and process development, it is not yet considered relevant to all divisions of the company.

The third and final stage relates to the external integration of environmental management. At this stage, environmental activities are integrated into the company's overall business strategy, including those focused on improving the corporate image. Companies operating at this stage understand that environmental management is a major factor affecting their competitiveness through economic and strategic benefits.

The economic benefits of integrating external environmental management activities include reductions in the consumption of input materials, and increased demand for products that reduce pollution. The strategic benefits include competitiveness, improving the organisation's institutional image, renewing its portfolio of products, increasing its productivity, and improving relationships with stakeholders. Such environmental management has a strong impact on management's decisions and is generally extended to all functional areas.

A firm's stance on carbon management can range from reactive initiatives like participating in ETSs and other forms of carbon emission offsets, to more proactive strategies such as innovative improvements to products, markets, technologies and processes, with a view to achieving carbon neutrality. Previous studies have typically focused on firms' efforts to reduce emissions through product development (e.g. Hoffman, 2005; Kolk & Pinkse, 2005; Boiral, 2006; Weinhofer & Hoffmann, 2010; Sprengel & Busch, 2011; Lee, 2012), process and supply improvement (e.g. Hoffman, 2005; Kolk & Pinkse, 2005; Jeswani et al., 2008; Weinhofer & Hoffmann, 2010; Lee, 2012), participation in ETSs (e.g Hoffman, 2005; Kolk & Pinkse, 2005; Boiral, 2006; Jeswani et al., 2008; Lee, 2012) and technological innovation (De Stefano, Montes-Sancho & Busch, 2016; Lee, 2013; Penna and Geels, 2015; Pinkse and Kolk, 2010). Hence, it would appear from the relevant social and environmental accounting literature reviewed in this study that firms are deemed to have adopted CMS irrespective of whether carbon emissions are managed reactively or proactively.

## 2.3 DIFFERENT TYPES OF CORPORATE CMS

Most research classifies corporate carbon strategies by characterising the carbon activities of the firm. For instance, Kolk and Pinkse (2005) grouped the *Financial Times*' (FT) 500 firms based on their carbon measures, and recognised six different climate

strategy configurations: (1) cautious planners; (2) emerging planners; (3) internal explorers; (4) vertical explorers; (5) horizontal explorers; and (6) emissions traders. The first two reflect a reactive posture towards mitigating GHG emissions, while the remaining four relate to companies with a more proactive approach, who are often in a more advanced stage of exploring market opportunities related to climate change.

As further explanation of Kolk and Pinkse's (2005) climate change strategy categorisations, cautious planners are still in the preliminary phase regarding the implementation of climate change strategy – they consider measures to reduce GHG emissions only as a possibility in the future. Similarly, emergent planners are in an early stage of implementing climate change strategy by setting a target for the reduction of energy consumption or GHG emissions – they are yet to implement measures beyond the process of target-setting and reducing emissions.

In contrast, internal explorers have taken a strong internal focus of combining targets and improvements in the production process; for most, the easiest attainable goal involves an improved production process in relation to energy efficiency, with the intention of emission reduction. Vertical explorers are identified by their strong focus on energy efficiency measures implemented within the supply chain; while increasing their knowledge of their activities' GHG emissions; they appreciate opportunities for developing more energy-efficient products and for sharing ideas and negotiating with their suppliers to reduce GHG emissions. There are two possible reasons for a company to concentrate on both upstream and downstream activities like this: (1) reliance on natural resources that are vulnerable to extreme weather conditions; and (2) the relatively low impact of the manufacturing process in comparison with the consumption of products (e.g. the automotive industry).

To add onto this dual focus, horizontal explorers also explore opportunities in markets outside of their current business scope, sometimes mutually with their partners. Furthermore, emissions traders are directly focused on the opportunities of emissions trading in combination with an internal reduction target that has a global reach and a favourable position towards new products and markets. That is, instead of offering products that facilitate emissions trading, these companies are trading certified emission reductions themselves or acting as an intermediary for other companies.

Following on from these categorisations, the empirical study by Jeswani et al. (2008) identified corporate response to climate change, resulting in a continuum scale of the following four categories: (1) indifferent; (2) beginner; (3) emerging; and (4) active. Indifferent relates to companies that are unconcerned about environmental issues and regulations; management is mostly unaware of environmental issues, with minimal understanding of the consequences of climate change. Indifferent firms are yet to take the first step towards climate change strategy, which is monitoring and preparing an inventory of their GHG emissions; thus, they do not engage in external activities, and only carry out some internal energy-efficiency activities primarily to cut costs.

The beginner category represents companies that have undertaken some operational activities specifically in relation to energy efficiency, but are at a very early stage. They have not yet prepared environmental management programs, with management allocating minimal resources for environmental protection activities. Thus, these companies emphasise energy-efficiency projects with low or no capital cost and relatively high payback.

The third emerging category by Jeswani et al. (2008) relates to companies that do more than the beginners, but are less committed compared to active. That is, they are not generally among the 'first movers', and instead follow the active leaders. While they have often already adopted EMSs, they have not necessarily certified them externally; they may be aware of their energy-efficiency obligations, but their actions are mostly limited to meeting the legal requirements. With regard to GHG emissions in particular, these emerging organisations often take actions such as preparing GHG inventory, benchmarking their emissions, setting GHG targets and formulating policy response; they also engage in external activities, especially those that are mandated by law such as having to sign agreements with regulatory bodies to reduce GHG emissions.

The fourth and final, active category is in complete contrast with indifferent organisations. Active firms generally have fully developed EMS, integrated with other business strategies, and most conduct an extensive range of operational activities including making changes in the product or input specifications to reduce their emissions, and partially substituting their fuel consumption with solar, wind, biomass or other renewable energy sources. These organisations have already prepared GHG inventories, conducted

energy assessments and identified improvement opportunities; they also actively engage with external stakeholders such as regulatory bodies, industry associations, suppliers and research companies, and participate in voluntary programs (Jeswani et al., 2008).

In another similar study, Weinhofer and Hoffmann (2010) categorised climate change strategies as follows: (1) carbon compensation; (2) carbon reduction; and (3) carbon independence. Carbon compensation describes the action taken by a firm to balance or offset its carbon emissions, such as buying carbon credits. In contrast, carbon reduction and carbon independence reflect a more proactive stance. Through carbon reduction, firms change production processes and products with a view to lowering their carbon emissions; in carbon independence, they implement measures that transform business operations to achieve independence from fossil fuels.

By focusing on climate change as an important ecological challenge, four general response strategies to GHG reduction pressures have been empirically-derived by Sprengel and Busch (2011):

1) Minimalists – This involves increasing GHG efficiency and informing various stakeholders of their own efforts towards GHG emissions reduction. GHG emissions management does not play a key role in minimalist strategy.
2) Regulation shapers – Going beyond increasing efficiency and informing stakeholders of reduction efforts; they actively participate in the political process to influence future regulation of GHG emissions.
3) Pressure managers – Exploring new markets with lower stakeholder pressures to reduce GHG emissions is the key and unique response of this category, coupled with attempts to acquire increased emission limits by obtaining additional emission capacity (e.g. by purchasing emissions allowances). Actively managing, influencing and reducing stakeholder pressures are characteristics of this strategy.
4) Emissions avoiders – This strategy is characterised by activities aimed at reducing the production and sale of carbon-intensive products, and fostering independence from GHG emissions. These companies attempt

to significantly reduce their GHG emissions beyond increasing GHG efficiency.

Using a cluster analysis, Lee (2012) identified six types of corporate climate change strategy: (1) wait and see observers; (2) cautious reducers; (3) product enhancers; (4) all-round enhancers; (5) emergent explorers; and (6) all-round explorers. Wait and see observers do not consider climate change a serious issue and show minimum interest in taking climate change measures. For cautious reducers, carbon management activities are in the initial stages. They mostly focus on setting emission targets and implementing carbon reduction measures for specific production processes; less importance is placed on product improvement or new markets.

Conversely, product enhancers mainly focus on developing more energy-efficient and less carbon-intensive products, predominantly to improve their market competitiveness. In contrast, all-rounder enhancers participate in widespread carbon management activities including product improvement for greener products, and emission reductions in the production process and the supply chain. After setting clear and specific emission reduction targets, they undertake measures to mitigate those emissions.

The next category of emergent explorers has the most clear and specific climate change plans in relation to entering into new business areas such as the new and renewable energy industries. They are often engaged in the exploration of opportunities in markets outside of their current business scope. Lastly, all-round explorers prioritise their competitiveness in existing business areas while also placing emphasis on new business opportunities. Most of the other characteristics of this category are reflective of those of the all-round enhancers and emergent explorers.

Based on previous studies reviewed, Table 2.2 presents a summary of the different types of climate change strategy.

**Table 2.2: Different types of climate change strategy**

| | **Climate change strategy** |
|---|---|
| Kolk and Pinkse (2005) | Cautious planners, emerging planners, internal explorers, vertical explorers, horizontal explorers, and emissions traders |
| Jeswani et al. (2008) | Indifferent, beginner, emerging and active |
| Weinhofer and Hoffmann (2010) | Carbon compensation, carbon reduction, and carbon independence |
| Sprengel and Busch (2011) | Minimalists, regulation shapers, pressure managers, and emissions avoiders |
| Lee (2012) | Wait and see observers, cautious reducers, product enhancers, all-round enhancers, emergent explorers, and all-round explorers |

## 2.4 MOTIVES BEHIND ENVIRONMENTAL RESPONSIVENESS

Understanding the differing motives for environmental responsiveness is important in predicting corporate environmental behaviour. Accordingly, various scholars have focused on why firms respond to environmental issues (e.g. Henriques & Sardorsky, 1996; De Villiers & Barnard, 2000; Hoffman, 2001; Khanna & Anton, 2002; Antonites & De Villiers, 2003; De Villiers, 2003; Darnall, 2006; Paulraj, 2008; Clarkson, Overell & Chapple, 2011a; De Villiers & Van Staden, 2011c). The most common factors identified as motivations for corporate environmental management initiatives are regulatory pressures, stakeholder pressures, increasing competitiveness, economic opportunities, gaining legitimacy, and top management initiatives (Lawrence & Morell, 1995; Bansal & Roth, 2000; Leal, Casadesus & Pasola, 2003; Delmas & Toffel, 2004). Among these motivations, competitiveness and legitimacy are regarded as the most significant drivers of environmental strategy and practices. Based on all of these prior studies in relation to identifying motivations behind organisations' adopting environmentally-friendly practices, the three most common influencers: competitiveness, legitimacy and stakeholder pressure are discussed in the next three sub-sections.

### 2.4.1. Competitiveness

Competitiveness is a motivator of firm behaviour that can be used at the country, industry and firm levels (Ambastha & Momaya, 2004). In general terms, competitiveness is described as the strength of an organisation in comparison with its competitors (Porter, 1980, 1985). That is, competitiveness is a comparative concept of the ability and performance of a firm, sub-sector or country to sell and supply goods or services in a

given market (Krugman, 1994). Competitiveness at the firm level is thus defined as the ability of a company to design and produce services and products superior to those offered by competitors, considering the price and non-price qualities (D'Cruz & Rugman, 1992).

From a traditional perspective, competitiveness has been regarded as tantamount to better firm performance (Porter, 1985). Yet this perspective is limited in that such competitiveness that is dependent on performance cannot fully account for intangible capital such as knowledge, relationships and reputation. To broaden the scope of firm competitiveness, it now also includes not only tangible but intangible resources (Hamel & Prahalad, 1989). As such, competitiveness also includes more dynamic firm capabilities such as flexibility, adaptability, and quality of products/services (Barney, 1991).

Yet despite the broadening of this motivator, the traditional view has often influenced the belief that environmental protection erodes competitiveness and in turn diminishes financial performance (Jaffe, Peterson, Portney & Stavins, 1995). According to this perspective, there is an inherent and fixed trade-off between ecology and economy. That is, consideration of the environment is associated with cost increases for companies, which means that many companies have used environmental resources with impunity. Firms' use of the environment at zero cost has been possible because the environment belongs to no one (or to everyone) (Hackett, 2006). Therefore, firms have often overused its resources without paying the true price, including causing serious environmental pollution (Hardin, 1968).

A new perspective has brought environmental management and competitiveness closer together. According to Porter and Van der Linde (1995), excessive pollution is a sign of inadequate technology and inefficient management. Thus, enhancing pollution control often requires innovative processes and products within organisations. Without such innovation, the need for environmental improvements will inevitably raise costs. In addition, companies need not sacrifice competitiveness to protect the environment insofar as innovative operations are adopted to achieve efficiency and resource productivity (Porter & Van der Linde, 1995). That is, competitiveness and environmental protection are complementary rather than polarising, which means that trade-off of one over the other is not necessary (Reinhardt, 2000).

As a complementary factor, competitiveness is now often seen as a key driver for proactive environmental initiatives adopted by firms beyond regulatory compliance (Bansal & Roth, 2000; Reinhardt, 2000). Numerous environmentally-conscious firms that are motivated by competitiveness have proven that their ecological responsiveness can lead to cost reductions, thereby improving profitability (Lampe, Ellis & Drummond, 1991; Cordano, 1993; Porter & Van der Linde, 1995). That is, by proactively addressing environmental issues, firms can reduce expenditures on raw material, energy and other operational costs related to risk management. Other cost reduction opportunities are also feasible in those firms where excessive pollution may affect their workers' health (Ambec & Lanoie, 2008). Furthermore, competitiveness via environmental management strategy can ensure revenue growth through better access to certain markets and differentiating products, including selling pollution control technology (Ambec & Lanoie, 2008). As consumer awareness of climate change has increased, companies have needed to respond to rapidly changing market demands by developing more climate-friendly products (Bonini, Hintz & Mendonca, 2008).

### 2.4.2. Legitimacy

Legitimacy refers to a firm's desire to align its actions within an established set of regulations, norms, values or beliefs (Suchman, 1995). If an actual or potential disparity exists between organisational and social values, then organisational legitimacy will be jeopardised, giving rise to a legitimacy gap (Sethi, 1979). When a firm's legitimacy is threatened, it will need to pursue a strategy to regain this legitimacy. However, society's perceptions of corporate activities are not static; they often change according to circumstances. Managers therefore need to recognise changing societal demands and respond accordingly to continue operating in an acceptable manner (Cotter & Najah, 2012).

Given the salience of climate change as a public concern, some companies are creating organisational structures that accept the overall responsibility for reducing their carbon emissions. The existence of organisational structures indicates that firms are taking climate change seriously, and using more systematic approaches to managing their carbon emissions. Such structures ensure adoption of EMSs including the presence of an environmental committee, or a dedicated board, team or individual responsible for GHG mitigation. Indeed, it appeals to intuition that firms with an EMS are more likely to be in

a superior position to address business risks associated with climate change and thereby appear legitimate. Such firms' environmental committees which are responsible for managing environmental risks also often tackle environmentally-related reputational risk and threats to legitimacy. Thus, it is conceivable that an environmental committee driven by legitimacy and reputation motives would be influence the firm to adopt CMS that attempts to mitigate carbon emissions. For instance, some firms have created climate governance boards at the executive level, which make it easier to communicate commitments towards carbon reductions to gain legitimacy (Carbon Disclosure Project, 2012)

Some firms driven by legitimacy participate in emissions trading or voluntary climate change programs to send a signal to regulators and public that they are reducing their carbon footprints (Lyon, 2003). In other instances, such firms voluntarily reduce carbon emissions by changing their processes or engaging in emissions trading, often because they foresee future regulations and wish to be in a favourable position when they are legislated. For example, Motorola adopted internal cap and trade schemes under the assumption that the regulation of GHG was inevitable (Revkin, 2003).

### 2.4.3. Stakeholder pressure

Some of the social and environmental accounting literature has investigated how firms react to environmental pressures from stakeholder groups. One main focus has been identifying where such pressures come from – that is, who the stakeholder groups are that demand environmentally-friendly practices (e.g. Henriques & Sadorsky, 1999; Buysse & Verbeke, 2003; Sharma & Henriques, 2005; Eesley & Lenox, 2006). Other studies have focused on actions and resources deployed by firms to meet such demands (e.g. Hart, 1995; Sharma & Vredenburg, 1998; Christmann, 2000; Bansal, 2005). There are also studies that have tested whether the strategic behaviour of firms to meet environmental goals is aligned with characteristics of their competitive strategy (Aragon-Correa, 1998; King & Lenox, 2000; Nakamura, Takahashi & Vertinsky, 2001).

Among stakeholders, regulators are often considered the most coercive force given their power and capabilities to establish environmental laws (Rugman & Verbeke, 1998; Paulraj, 2008). In their study, Henriques and Sardorsky (1996) found government regulations to be the single most important source of pressure on firms in relation to the

development of environmental plans. Regulatory uncertainty relating to GHG emissions has been identified as a key factor causing such varied corporate reactions (Engau & Hoffman, 2010). Despite an increasing number of companies beginning to take a more proactive stance on climate change, many firms remain relatively passive choosing to adopt a 'wait-and-see' attitude. Regulatory compliance provides the greatest motivation for firms to proactively search for innovative ways to reduce pollution and improve production efficiency (Williamson, Lynch-Wood & Ramsay, 2006; Burnett & Hansen, 2008). Sullivan (2009) added that climate change regulatory uncertainties act as a primary deterrent for many large firms in Europe to adopt a proactive stance in managing GHG emissions. On the disclosure front, Reid and Toffel (2009) reaffirmed that the threats of state regulations increase the likelihood of firms providing information on climate change strategies and carbon-related disclosures. Many firms' engagement in the ETS is largely motivated by regulatory compliance (Pinkse, 2007). In line with this, Okereke (2007) identified regulation as a major driver of corporate climate strategy among the United Kingdom's FTSE 100 companies. In the United States, there have been many federal- and state-level climate change initiatives (e.g. Combined Heat and Power Partnership, EnergyStar, Climate Leaders) which aim to increase energy efficiency and reduce GHG emissions (Hsueh & Prakash, 2009). While such initiatives in the United States have been voluntary in nature, they have been some of the most prominent drivers of carbon management of firms.

Institutional investors in particular are becoming increasingly cautious about the financial implications of neglecting climate change as a business strategy (Jones & Levy, 2007). For example, many of the leading investment banks now issue restrictive guidelines for carbon-intensive investments (Okereke, 2007; Kolk & Pinkse, 2008a; Sullivan & Pfeifer, 2009). In line with such investment standards, many companies are under increasing pressure to disclose information about their carbon emissions. Investors are therefore a key influence on company decision-making, and their views on climate change are becoming important determinants of how firms will manage their carbon emissions.

Consumer and shareholder pressures are also rising, particularly in environmentally-sensitive markets and in competitive sectors where brand loyalty is an important part of corporate values (Hoffman, 2005; Lash & Wellington, 2007). For example, fossil-fuel-dependent sectors are more often being taken to court due to their

negative impact on the environment and climate change in particular. Firms generating significant carbon emissions now face the threat of lawsuits similar to those common in the tobacco, pharmaceutical and asbestos industries. Furthermore, companies that do not adequately address the issue of climate change can cultivate personal liabilities for directors who are vulnerable to shareholder-related litigation (Lash & Wellington, 2007).

Based on the above three main influencers of competitiveness, legitimacy and stakeholder pressure, firms' motives for CMS adoption can be largely divided into: (1) competitiveness as the potential for ecological responsiveness to improve long-term profitability and to achieve greater internal efficiencies; (2) legitimacy as the desire of a firm to improve the appropriateness of its actions within an established set of regulations, norms, values or belief; and (3) responding to key stakeholder pressure as a way to demonstrate they are concerned about the interests of stakeholders when making strategic decisions. To get a deeper understanding of CMS adoption, these three main motives are next linked to the three main theoretical perspectives used on in this study: RBV; legitimacy theory; and stakeholder theory. These theories are discussed in the next three sections.

## 2.5 RESOURCE-BASED VIEW (RBV) PARADIGM

The RBV of the firm has become one of the most influential paradigms in strategic management literature. RBV relates to the identification and possession of internal strategic resources that contribute to a firm's ability to create and maintain a competitive advantage and improve performance (Barney, 1991; Hart 1995; Barney & Arikan, 2005; Crook, Ketchen, Combs & Todd, 2008). It highlights a firm's internal characteristics as the foundation for its business strategy (Barney, 1991). According to RBV, each organisation possesses unique resources which are different to those held by others (Penrose, 1959; Wernerfelt, 1984; Peteraf, 1993). Originating in the work of Penrose (1959), RBV contends that every firm is a bundle of potential resources. As part of RBV, Wernerfelt (1984) later described such resources as anything that can be perceived as a strength or weakness of a firm. In Barney's (1991, p. 101) work, a firm's resources are defined to include:

> All assets, capabilities, organizational (sic) processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to

conceive of and implement strategies that improve its efficiency and effectiveness.

Organisations build a competitive advantage by combining, developing and using these unique set of resources to develop capabilities to improve efficiency and effectiveness (Wernerfelt, 1984; Hansen & Wernerfelt, 1989; Barney, 1991; Lichtenstein & Brush, 2001; Barney & Arikan, 2005). Although many such resources are developed internally, they can also be obtained via external sources such as business partnerships. The classification of resources is discussed next.

### 2.5.1 Classification of resources

Organisational resources are the basic units of analysis in the RBV which input into the production process (Grant, 1991); they are commonly classified as tangible, intangible and personnel-based resources (Wernerfelt, 1984; Grant, 1991). Tangible resources include financial capital and physical assets of the firm such as plant, property, equipment and stocks of raw materials (Barney, 1991; Russo & Fouts, 1997); intangible resources include reputation, brand image, patents and product quality (Grant, 1991); and personnel-based resources include technical know-how and other knowledge assets such as organisational culture and employee training and loyalty (Wernerfelt, 1984; Russo & Fouts, 1997).

In addition to the above main resource classifications, Barney (1991) specified three distinct types of capital resources that can provide a firm with a competitive advantage: (1) physical capital resources; (2) human capital resources; and (3) organisational capital resources. Physical capital resources include the physical technology used in a firm, a firm's plant and equipment, its geographic location, and its access to raw materials. Human capital resources include the training, experience, judgement, intelligence, relationships and insight of individual managers and workers in a firm. It has been suggested that these knowledge-based resources, particularly those related to technological change and the capacity to innovate, are among the main driving forces behind an organisation's competitive advantage (Porter, 1985; Barney, 1991; Barney & Arikan, 2005). Organisational capital resources include a firm's formal reporting structure, its formal and informal coordinating systems, as well as informal relations among groups within a firm and between firms (Barney, 1991).

In addition to such resources controlled by an organisation, it must also have the capabilities to manage its resources. Such organisational capabilities are the capacity to deploy resources; that is, coordinating internal mechanisms to enable the most efficient and effective use of the firm's assets, as the main source of competitive advantage (Amit & Schoemaker, 1993; Christmann, 2000; Darnall & Edwards, 2006). These capabilities can be classified as inside-out, outside-in and spanning (Grant, 1991). Inside-out capabilities are deployed from within the firm to respond to market requirements and opportunities; outside-in are externally-focused, emphasising anticipated market requirements; and spanning involves both internal and external analyses, to integrate both inside-out and outside-in organisational capabilities (e.g. managing partnerships and information services management) (Wade & Hulland, 2004).

The next section discusses how the accurate classification of resources can help organisations achieve competitive advantage.

### 2.5.2 Competitive advantage

The fundamental tenet of RBV is that resources should provide a competitive advantage for the firm. When a firm is "implementing a value creating strategy not simultaneously being implemented by any current or potential competitors" (Barney, 1991, p. 102), it must be valuable and rare. Such valuable resources enable an organisation to develop strategies that improve its efficiency and effectiveness. While its competitive advantage may also stem from other organisational attributes, they are only considered as resources when they exploit opportunities or offset threats from competitors (Barney, 1991). It has also been suggested that the information system assets of an organisation are valuable resources because they improve the organisation's efficiency (Wade & Hulland, 2004) and its ability to identify opportunities and competitive advantage.

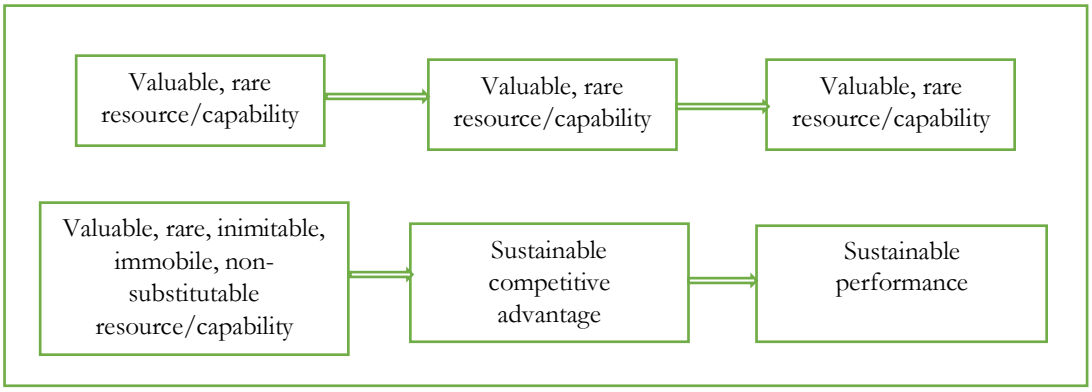
Yet even if a resource is valuable, if it is also available to the firm's competitors it will not provide a competitive edge. To ensure a competitive advantage, a valuable resource must also be rare. While a rare and valuable resource may not necessarily be something unique to an organisation, it should only be available to a handful of competitors to create a "perfect competition dynamics" (Barney, 1991, p. 107). Such rare, highly potent resources, available to only a few organisations, often stem from exceptional property rights, mobility barriers or due to the very nature of the resource (e.g.

organisational culture). As an example of valuable versus the combination of valuable and rare, automated teller machine (ATM) technology is essential to a bank's competitiveness and is therefore a valuable resource. Although valuable, it cannot give leverage to a particular bank as most in the industry now possess this resource. However, if a bank innovated a new and rare technology within its ATMs (e.g. the ability to pay bills via the ATM), this combination of resources then provides a competitive advantage.

### 2.5.3 Sustainable competitive advantage

While valuable and rare resources provide organisations with a competitive advantage, such assets may not be durable if competitors are able to replicate the fundamental elements of that resource. A sustainable competitive advantage can only be achieved if the chosen strategy is supported by sufficient resources and capabilities (Barney & Arikan, 2005; Clarkson et al, 2011a). Barney (1991) based his corresponding articulation of the RBV on two fundamental assumptions: (1) that resources (and capabilities) are heterogeneously distributed among firms; and (2) that resources are imperfectly mobile. These assumptions allow for differences in a firm's resource endowments to both exist and persist over time, thereby allowing for a resource-based competitive advantage. Furthermore, drawing heavily on Dierickx and Cool (1989), Barney (1991) contended that in order for a firm to sustain these advantages over a longer period of time, its resources must also be inimitable, immobile and non-substitutable. Barney's (1991) Conceptual Model which highlights the importance of non-substitutable resources to ensure long-term stability is illustrated in Figure 2.1.

**Figure 2.1: Barney's (1991) Conceptual Model**




Source: Newbert (2007)

*Resource inimitability:* If competing firms manage to imitate the resource that provided an organisation with a competitive advantage, it would cease to be rare, meaning that the competitive advantage was only temporary. Thus, resources that can provide a sustainable competitive advantage must be rare as well as difficult to emulate. One way of achieving such inimitability is via causal ambiguity, which is the use of resources that are unique (Barney, 1991; Peteraf, 1993). Casual ambiguity often applies when the source of the competitive advantage is either unknown or difficult to comprehend by virtue of its nature. Outside-in and spanning resources tend to be more inimitable, as each set of resources uniquely evolve with specific firm characteristics. Such resources are also often socially complex within the organisation (Wade & Hulland, 2004), such as the cohesion of an upper management team (Michalisin, Karau & Tangpong, 2004).

*Resource immobility:* Sustainable competitive advantage also requires resource immobility (or imperfect mobility). That is, a firm may lose its competitive advantage if the resource(s) that created the advantage are able to leave the organisation or be fully appropriated by other firms (Peteraf, 1993). Immobility ensures the resources are more immune to replication by competitors (Barney, 1991; Peteraf, 1993).

*Resource non-substitutability:* In addition to the above, resources need to be strategically non-substitutable to generate a sustainable competitive advantage. Otherwise a resource may be substituted with something similar that would allow the organisation and competitor to implement similar strategies (Barney, 1991). While outside-in and spanning resources are unlikely to be substitutable, firms that have a subset of these capabilities may still be able to stand out from other firms controlling a different subset of the same capabilities (Wade & Hulland, 2004).

Based on RBV, firms aim to identify resources that are most likely to give them a competitive edge in the market and then utilise them to exploit their value (Sirmon, Hitt & Ireland, 2007). However, mere identification and possession of resources will not fully impact firm performance (Sirmon et al., 2007). These resources need to be managed effectively given the external circumstances the organisation may face in the competitive business environment (Lippman & Rumelt, 2003). Indeed, the overall resource management process can significantly affect firm performance (Zott, 2003). Strategic resources in a firm do not necessarily work independently to create value (Amit &

Schoemaker, 1993; Black & Boal, 1994); rather a combination of resources that are dependent on each other through a causal relationship can create value that far exceeds that created by the standalone resource (Dierickx & Cool, 1989; Black & Boal 1994). A systematic review of empirical research based on RBV indicated that a combination of resources is more likely to underpin high performance in firms (Newbert, 2007).

While the RBV highlights the importance of valuable, rare, inimitable, and non-substitutable resources as preconditions for a firm's competitive advantage, it does not reflect the constraints imposed by the natural environment. Consequently, Hart (1995) proposes a Natural-Resource-Based View (NRBV) of the firm by incorporating the firm's relationship to the natural environment as a potential source of competitive advantage. This is further discussed next.

### *2.5.4 Natural-Resource-Based View (NRBV) of the firm*

Hart (1995) argues that one of the most important drivers of new resource and capability development for firms will be the constraints and challenges posed by the natural environment. Moreover, given the increasing pressure to protect the natural environment, organisations that do not make requisite changes could lose their competitiveness. The NRBV and its extensions (Hart, 1995, 1997; Hart and Dowell, 2011) introduce three strategies based upon specific resource capabilities: (1) *pollution prevention* based on tacit capabilities; (2) *product stewardship* based on socially complex capabilities; and (3) *sustainable development* based on rare firm-specific capabilities. For each of the strategy, Hart (1995) proposes that where a firm has the existing resource capabilities (tacit, socially complex, rare firm specific), the firm will be able to execute the proposed strategy more quickly. Thus the strategy enables firms to enhance environmental performance and, in turn, obtain a competitive advantage (Porter & Van der Linde, 1995; Russo & Fouts,1997; King & Lenox, 2002).

Pollution prevention strategy aims to enhance internal efficiencies in production and operations. Their main objective is to prevent waste and emissions, rather than cleaning them up at the "end of the pipe". By removing pollutants from the production process, pollution prevention strategy allows cost reductions by (a) reducing the inputs required, (b) simplifying the process, and (c) cutting compliance and liability costs (Hart

and Dowell, 2011). Through lowering operational costs, pollution prevention strategy may improve competitiveness.

Product stewardship strategy focuses beyond the firm's processes by integrating environmental concerns into product design decisions. The overall objective is to minimise the life cycle ecological impacts of products. Thus, through product stewardship strategy, firms can (a) minimise environmentally hazardous processes, (b) redesign existing product systems to reduce liability, and (c) develop products with lower life-cycle costs (Hart, 1995; De Stefano et al, 2016). This strategy also actively incorporates external stakeholders in the product-development and planning processes. The accumulation of socially complex resources based on communication with external stakeholders provides an opportunity for sustained competitive advantage through the exploitation of these resources.

A sustainable development strategy represents the highest level of environmental engagement strategy. Companies' sense of social responsibility is the main driver of adopting this strategy. Such firms have a long-range vision which will be key to creating internal pressure and enthusiasm to initiative the needed changes (Hart, 1995; De Stefano et al, 2016). Firms which have this vision will likely be leaders in bringing new environmentally friendly technologies to the market place.

Historically, the NRBV offers a connection between the natural environment and a firm's resources and capabilities. In line with this, environmental orientation has been recognised as related to corporate strategies and capabilities (Banerjee, Iyer & Kashyap, 2003). It has also been linked to higher operational and economic performance (Fraj-Andrés, Martinez-Salinas & Matute-Vallejo, 2009). Hence, such evidence suggests that environmental orientation can be a source of competitive advantage and shape firm performance. This is further discussed next.

### 2.5.5 Environmental orientation

A firm's orientation is an underlying perception that guides the nature and scope of its internal and external activities (Miles & Munilla, 1993; Kotler, 1997). That is, such orientation can be seen as the way a firm conceives and responds to the business environment in which it functions. It consists of an internal system that binds together

different aspects of a firm to form an orderly arrangement of beliefs and behaviours (Fiol, 1991). Synergy of these beliefs and behaviours is often an important competitive resource through a cognitive process that is unique and valuable to the firm, and difficult to imitate (Barney, 1991; Fiol, 1991). Orientation of a firm can positively impact its operational competitiveness (Mello & Stank, 2005).

Research on strategic management literature in relation to environmental orientation identified that a firm encourages culture of environmental awareness and priority (Hart, 1995; Shrivastava, 1995). The term 'environmental orientation' is used to describe this ethic as a business philosophy including the degree to which environmental values are integrated within a firm's culture (Fraj-Andrés et al., 2009). More specifically, environmental orientation is defined as "the recognition by managers of the importance of environmental issues facing their firms" (Banerjee et al., 2003, p. 106). As suggested in the RBV paradigm, environmental orientation can be viewed as a strategic resource because it is tacit, abstract, difficult to transfer, and can possibly improve a firm's financial performance (Hult, Ketchen, Adams & Mena, 2008).

Firms with an environmental orientation recognise the need for minimising their impact on the natural environment, and the importance of a proactive corporate stance towards environmental responsibility as part of the firm's strategic objectives (Banerjee, 2001; Baker & Sinkula, 2005). Environmental orientation has also been identified as a learning process in the collective consciousness of a firm in relation to its environmental responsibility (Banerjee, 2001; Menon & Menon, 1997; Shrivastava, 1995). Values and beliefs that result from environmental orientation generally foster the creation and implementation of strategic EMSs (Mintzberg, 1994a; 1994b; Banerjee et al., 2003; Fraj-Andrés et al., 2009).

The strategic management literature commonly conveys that environmental orientation generally relates to two main dimensions within a firm that are both internal and external (Banerjee, 2001; Banerjee et al., 2003; Fraj-Andrés et al., 2009). First, environmental orientation is internally-focused and is based on the internal values, standards of ethical behaviour, and commitment to environmental responsibility of the firm, and is guided by its corporate mission statements (Fraj-Andrés et al., 2009). Firms with an internally-focused environmental orientation instil ethical behaviour towards the

environment across different business areas, and consider environmental objectives as integral to their economic goals (Shrivastava, 1995). Thus, an internally-focused environmental orientation is supported by corporate management and involves decisions related to the generation and dissemination of environmental information throughout the firm, including communication of environmental mission statements, the appointment of environmental managers, and the implementation of environmental projects (Fraj Andrés et al., 2009).

Second, environmental orientation is also externally-focused, which is based on managers' perceptions of external forces and the need to respond to stakeholder interests. An externally-focused environmental orientation is a corporate culture that also strives to create a positive environmental image to stakeholders (Menon & Menon, 1997; Banerjee, 2002). Externally-focused environmental orientation of a firm contributes to a firm's larger goal of attaining legitimacy in the eyes of stakeholders; thus, it is often considered as one of the strongest motivators of corporate action towards improving environmental responsibility (Hart, 1995; Banerjee, 2001). Managerial perceptions of the external business environment are critical to strategic resource identification and acquisition (Aragon-Correa & Sharma, 2003; Sirmon et al., 2007). That is, managers who perceive environmental issues as opportunities rather than threats will identify specific strategic resources to create value for the firm via environmental strategies and practices (Menon & Menon, 1997).

Within the environmental management literature, some researchers have argued that the ability to integrate the natural environment into the strategic planning process is a unique organisational capability (Russo & Fouts, 1997; Judge & Douglas, 1998; Aragon-Correa & Sharma, 2003). More commonly, studies have sought to identify the unique capabilities developed by firms that adopt more proactive environmental strategies, including their contribution to sustainable competitive advantage. The view taken in this study is that insights from the RBV may help clarify the role of strategic resources in adopting CMS including its implications for both financial and carbon performance.

As discussed previously, RBV is concerned with the management of internal resources to achieve competitive advantages that impose a legitimacy requirement for firms. Consequently, legitimacy is treated as an operational resource that organisations

competitively extract from the environment for the pursuit of their goals (Dowling & Pfeffer, 1975; Ashforth & Gibbs, 1990). Firms adopting environmental initiatives with a legitimation motive emphasise survival, compliance with norms, and competitive advantage. In line with this, legitimacy theory posits that the existence of a corporation is recognised both by market forces and community expectations; thus, an understanding of the wider concerns of society becomes an essential prerequisite for a corporation's survival. The following section provides a detailed discussion of legitimacy theory.

## 2.6 LEGITIMACY THEORY

Legitimacy theory is the most prevalent theory used in accounting research (Parker, 2005). Legitimacy theory is based on the idea of a social contract between a firm and society, where the firm must act within the boundaries of what society identifies as socially acceptable behaviour in order to continue its operations successfully (O'Donovan, 2002). This theory relies on the assumption that managers will adopt strategies to demonstrate to society that the organisation is complying with societal expectations. Shocker and Sethi (1974, p. 67) defined the social contract as follows:

> Any social institution – and business is no exception – operates in society via a social contract, expressed or implied, whereby its survival and growth are based on:
> 1) the delivery of some socially desirable ends to society in general; and
> 2) the distribution of economic, social, or political benefits of groups from which it derives its power.
>
> In a dynamic society, neither the sources of institutional power nor the needs for its services are permanent. Therefore, an institution must constantly meet the twin tests of legitimacy and relevance by demonstrating that society requires its services and that the groups benefiting from its rewards have society's approval.

The social contract or "licence to operate" (Deegan, Rankin & Tobin, 2002, p. 319) is an implicit agreement between an organisation and the society. Although profit maximisation is the main objective, the organisation also has a moral obligation to engage in socially-responsible behaviour (O'Donovan, 2002). Failure to meet the terms of the social contract may jeopardise the organisation's continuing operations (Deegan et al., 2002). A breach of the social contract may cause the society to penalise the organisation by demanding increased regulation regarding its activities or by discontinuing the provision of resources.

### 2.6.1 Organisational legitimacy

Organisational legitimacy represents the reaction of observers in society to the organisation. According to Suchman (1995, p. 574):

> Legitimacy is a generalized (sic) perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs and definitions.

In relation to this definition of organisational legitimacy, Suchman (1995) highlighted its three main features as follows: (1) legitimacy is generalised; (2) legitimacy is a perception or assumption; and (3) legitimacy is socially constructed. Legitimacy is generalised in this sense, as it is conceived on the basis of a history of events viewed as a whole rather than any single event. Thus, an organisation may infrequently engage in behaviour that is incongruent with social norms yet can maintain legitimacy, given that the incongruent behaviour is considered to be unique. Furthermore, organisational legitimacy is a perception or assumption as it signifies observers' perceptions of an organisation "as they see it" (Suchman, 1995, p. 574); thus, it results from collective subjective observations. An organisation may therefore deviate considerably from social norms while retaining its legitimacy if the deviation goes unnoticed. Lastly, organisational legitimacy is a social construct as it indicates a resonance between the activities of the organisation and the collective values of specific social group (i.e. stakeholders). Thus, legitimacy often depends on perceptions of a collective audience while remaining independent of individual observers. This means that the behaviour of an organisation may conflict with an individual's values yet retain legitimacy, as the behaviour does not incur disapproval from the broader society.

Organisational legitimacy is highly dependent on communication between the organisation and its various stakeholders (Elsbach, 1994). Legitimacy management requires skilful and diverse techniques, and the ability to decide the appropriate response for each situation. An organisation cannot completely satisfy all stakeholders. Suchman (1995) suggested that the conflict between social systems of belief (or points of view) is responsible for the competition and conflict among organisations, and thus the necessity to take a strategic approach to legitimacy.

Many researchers assume that managers have a high level of control in the process of organisational legitimation (e.g. Ashforth & Gibbs, 1990). They believe that this legitimisation process often involves competitive conflict that is calculated and intentional. For example, managers favour the economy and flexibility of symbolism, but constituents prefer responses that are more substantive. Therefore, organisational legitimacy predicts that managers will deliberately have conflicts with constituents over the method of legitimisation chosen.

A firm's motives for legitimation are theorised by Bansal & Roth (2000) to be influenced by three primary variables: (1) issue salience; (2) field cohesion; and (3) individual concern. All of these variables impact positively on firms seeking legitimacy through environmental initiatives. Salience issues are those where the impacts are easily determined, quantified in monetary value, and easily attributed to the firm – they generally elicit a negative emotional response from constituents. In addition, salience issues tend to produce the greatest reactions in society and are often perceived by firms as a threat to their legitimacy and subsequent profitability.

The next primary variable of field (industry or sector) cohesion is focused on the intensity and density of both formal and informal networks between constituents and the organisation (Bansal & Roth, 2000). Field cohesion is increased by negative impressions of the industry's ecological impacts and by the activities of industry associations. Firms in highly cohesive fields often conform to industry norms and values for two major reasons. First, standing apart from an industry's green initiatives is difficult because of information-sharing and informal approvals. Second, individual corporate superior performance is seen as undesirable because it could raise the standard and result in higher costs for all. Thus, firms in highly cohesive fields are often strongly motivated by legitimacy concerns as their survival depends on the cohesive behaviour of all field members (Milne & Patten, 2002). In addition, individual concern (leadership, values, etc.) is a powerful factor in explaining why some firms are motivated by a desire to be ecologically- and socially-responsible – it often strengthens the legitimation motive within firms in highly cohesive fields (Milne & Patten, 2002).

### 2.6.2 Legitimacy gaps

The expectations of society vary over time, including in accordance with the socially constructed reality in which the organisation operates (Deegan et al., 2002; Samkin & Schneider, 2010). Organisations therefore need to be responsive to shifting environments pertinent to their operations, where society's perceptions regarding legitimate organisational behaviour may change over time. Legitimacy gaps may occur when society's perceptions of organisational goals are incongruous with the actual organisation targets (Milne & Patten, 2002).

Legitimacy gaps may result from three types of changes: (1) changes in corporate activities while societal expectations remain stable; (2) changes in societal expectations while organisational activities remain stable; and (3) opposing changes in both societal expectations and organisational activities (O'Donovan, 2002). Furthermore, threats to legitimacy may arise from poor decisions within the organisation, inattention to potential problems, failure to uphold ethical responsibilities (Milne & Patten, 2002), or simply a difference between societal expectations and organisational actions. In the case of a legitimacy gap, a variety of legitimation tactics of disclosure can be adopted by the organisation to restore its legitimacy.

In addressing such gaps, legitimacy theory suggests that managers will adopt strategies that demonstrate to society they are meeting the expectations of the social contract (Deegan et al., 2002). While there are many strategies that may be adopted by managers seeking to demonstrate behaviour congruent with the expectations of society, for the purposes of this study the discussion focuses predominantly on CMS adoption. It is proposed that the legitimacy theory offers an appropriate theoretical context to examine the internal drivers of CMS adoption.

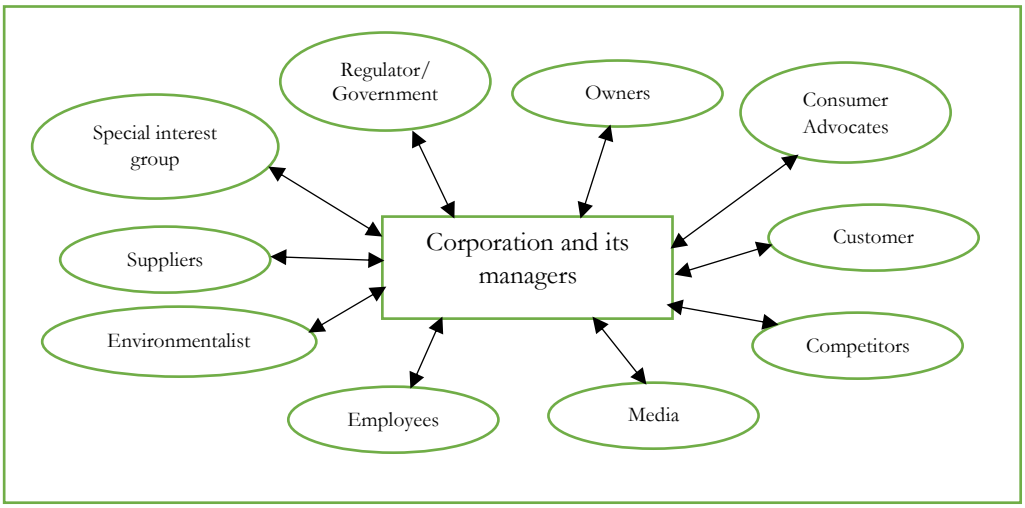
In the field of accounting research, legitimacy has gained prominence in explaining the importance of social influences on corporate strategic decisions (Ingram & Silverman, 2002). However, legitimacy theory considers the whole society. It does not recognise that society comprises of numerous stakeholders with different powers and interests to impact on a firm's activities (Deegan, 2002). It is stakeholder theory that considers these different groups, as discussed in the following section.

## 2.7 STAKEHOLDER THEORY

As outlined by Freeman (1984), stakeholder theory recognises the fact that most firms have a large and integrated set of stakeholders to which they have an obligation and responsibility (Spence, Coles & Harris, 2001). This theory embodies the need to balance the expectations of certain shareholders with that of other stakeholders, to attract and maintain the support of all relevant stakeholders (Reynolds, Schultz & Hekman, 2006). Stakeholder theory is based on the concept that the management of stakeholder expectations is central to organisational performance, and as such must receive explicit consideration when organisational strategies are being formulated.

When discussing stakeholder theory, Freeman (1984, p. 41) defined stakeholders "as any individual or group who has an interest in the firm because he (or she) can affect or is affected by the firm's activities". This is a more comprehensive grouping of stakeholders, extending beyond those that have formal relationships with the firm. Freeman (1984) introduced the stakeholder view of the firm map to show the range of potential internal and external stakeholders such as owners, customers, government bodies, suppliers and employees (see Figure 2.2).

**Figure 2.2: Stakeholder view of the firm – stakeholder map**




Source: Freeman (1984)

This map illustrates interactions between different stakeholders and firms and their managers, which go both ways – that is, the firm with its stakeholders and

stakeholders with the firm. This map can be used by any organisation that operates in a turbulent environment, regardless of size or level, to identify their key stakeholders.

### 2.7.1 Categorisation of stakeholders

Prior studies (Freeman, 1984; Clarkson, 1995) have classified stakeholders as either primary or secondary. While a primary stakeholder is "one without whose continuing participation the corporation cannot survive as a going concern", secondary stakeholders are those who influence or affect, or are influenced or affected by the company (Clarkson, 1995, p. 106). The latter are not essential to the organisation's survival and are not generally involved in company transactions. While Clarkson's (1995) categorisation of stakeholders is consistent with Freeman's (1984), the latter believed that while secondary stakeholders such as non-government organisations (NGOs) and the media may be less significant, if ignored they could become a powerful group in the future and have a direct influence on a firm's operations.

It is commonly perceived that primary stakeholders include supply chain participants (from commercial buyers and household consumers to suppliers) and internal stakeholders (from management to non-management employees), who both have a direct economic stake in the firm (Donaldson & Preston, 1995; Darnall Henriques & Sadorsky, 2010). Supply chain participants generally respond positively to a firm's environmental actions – for example, commercial buyers and household customers choose to purchase the firm's products or services, while suppliers choose to renew their sales agreements (Darnall et al., 2010). That is, they express their satisfaction or dissatisfaction through direct engagement with managers. While commercial buyers, household consumers and suppliers can all file a suit against the firm, manifestation of dissatisfaction may differ – household consumers are more likely to engage in public boycotts (Henriques & Sadorsky, 1999; Darnall et al., 2010), while corporate buyers and suppliers are likely to respond by cancelling purchase or sale agreements, stopping delivery of an input, or demanding for environmentally-sound substitutes.

The other primary group of internal stakeholders is generally comprised of management and non-management employees who are associated with the success or failure of firm strategies (Freeman, 1984). Employees with an understanding of the firm's environmental goals are more likely to continue their employment (Henriques &

Sadorsky, 1996). They may also express satisfaction or dissatisfaction through direct discussion with the firm's executives or corporate boards. Dissatisfaction of both management and non-management employees can be expressed via employment termination. In more extreme cases, employees may engage in public whistle-blowing that exposes the firm's potentially negligent environmental practices (Darnall et al., 2010).

On the other hand, secondary stakeholders include societal stakeholders (Klassen & McLaughlin, 1996; Waddock & Graves, 1997; Henriques & Sadorsky, 1999; Darnall et al., 2010) and environmental regulators (Waddock & Graves, 1997; Henriques & Sadorsky, 1999). An increasing influence of societal stakeholders is one of the most significant developments in international affairs over the past two decades since 1990 (Doh & Guay, 2006; Darnall et al., 2010). Societal stakeholders consist of public interest groups such as environmental and community organisations (Hoffman, 2000), and professional groups such as labour unions and industry associations (Etzion, 2007). They have the capacity to mobilise public opinion in favour of or against the firm (Freeman, 1984). Societal stakeholders generally resort to indirect approaches (e.g. public protests, strikes and industry calls for engagement) to influence firm behaviour because they lack a direct economic stake in the organisation (Sharma & Henriques, 2005; Darnall et al., 2010).

The other group of second stakeholders, known as environmental regulators, are individuals within governments with the authority to establish environmental rules and legislation, and monitor company compliance with them (Fineman & Clarke, 1996; Carmin, Darnall & Mil-Homens, 2003; Darnall et al., 2010). Firms that fail to comply with such environmental requirements or to maintain satisfactory communications with regulatory stakeholders are prone to incurring non-compliance penalties and having their operating permits revoked (Henriques & Sadorsky, 1996; Darnall et al., 2010).

In general, stakeholder theory proposes diverse clarification of who a stakeholder is and how to identify them. Thus, Mitchell et al. (1997) suggested a normative theory of stakeholder identification to separate stakeholders from non-stakeholders in a logical manner. To this end, they introduced the following typology as discussed below delineating to whom and to what managers should pay attention to.

### 2.7.2 Stakeholder identification and salience

Mitchell et al. (1997) initiated their typology with a broad definition of stakeholder so that no stakeholders – potential or actual – would be excluded from the analysis. The classes of stakeholders are identified according to their possession of three specific attributes: (1) the stakeholder's power to influence the firm; (2) the legitimacy of the stakeholder's relationship with the firm; and (3) the urgency of the stakeholder's claim on the firm. These attributes create a typology of stakeholders based on the normative assumption that these variables determine which stakeholder group managers should pay attention to. Mitchell et al. (1997, p. 854) defined stakeholder salience as follows:

> The typology permits the explicit recognition of situational uniqueness and managerial perception to explain how managers prioritise stakeholder demands. Moreover, it demonstrates how the identification typology predicts managerial behaviour with respect to each class of stakeholder, as well as predictions about how stakeholders change from one class to another and how a manager would interpret them.

The power attribute relates to the ability to bring about outcomes of desire or the ability of one actor within a social relationship to have another actor do something that they would not otherwise have done (Mitchell et al., 1997). That is, the power of the stakeholder over the organisation may be coercive (strength or threat), normative (legislative or media), or utilitarian (holding resources or information). The legitimacy attribute is the perception or belief that stakeholders' claims are proper, desirable or appropriate in accordance with the socially constructed context which may be individual, organisational or social. The urgency attribute is defined as the degree to which stakeholder claims call for immediate attention. Mitchell et al. (1997) believed that urgency only exists when two conditions are met. First, when a relationship or claim is of a time-sensitive nature (i.e. the degree to which managerial delay in attending to the claim or relationship is unacceptable to the stakeholder); and second, when that relationship or claim is important to the stakeholder.

Mitchell et al.'s (1997) typology identifies three different stakeholders: (1) latent; (2) expectant; and (3) definitive. These types of stakeholders are based on various combinations of the power, legitimacy and urgency attributes. Where none of these attributes are present, they are not considered stakeholders and are instead perceived as having no salience to the managers of the organisation. There are seven stakeholder types

introduced conceptually and logically: three with only one attribute; another three with two attributes; and one with all three attributes. Table 2.3 presents these different stakeholder types as identified by Mitchell et al. (1997), including their attribute combinations.

**Table 2.3: Stakeholder types according to stakeholder attributes**

| Stakeholder types | Stakeholder attributes | | | Comment |
|---|---|---|---|---|
| | Power | Legitimacy | Urgency | |
| *Latent stakeholders* | | | | |
| Dormant stakeholders | √ | - | - | Power is not useful since legitimacy is lacking |
| Discretionary stakeholders | - | √ | - | Relates to social responsibility |
| Demanding stakeholders | - | - | √ | Irksome, but not dangerous |
| *Expectant stakeholders* | | | | |
| Dominant stakeholders | √ | √ | - | They form dominant coalition in firm |
| Dangerous stakeholders | √ | - | √ | Coercive and sometimes violent |
| Dependent stakeholders | - | √ | √ | Depend upon other stakeholders or organisation's management for power |
| *Definitive stakeholders* | √ | √ | √ | Defines organisation's direction – any expectant stakeholder can become definitive by acquiring the missing attribute |
| *Non-stakeholders* | - | - | - | Generally ignored – no salience with manager |

Source: Mitchell et al. (1997)

As discussed before, stakeholders' salience is critical to stakeholder management and should be factored in by a firm for effective stakeholder management. That is, the more salient the stakeholders are, the more priority they should receive from a firm. Thus, the firm's management should properly identify and manage powerful stakeholders to ensure continued survival. This now includes the pressure on companies from various stakeholders to take climate change into account within their business strategies (Weinhofer & Hoffmann, 2010; Sprengel & Busch, 2011). Thus climate-specific stakeholder pressure is fuelling a sense of urgency to go beyond efforts to increase carbon transparency alone and start considering more substantive ways to reduce carbon emissions (Pinkse & Busch, 2013). Given this, stakeholder theory offers a suitable

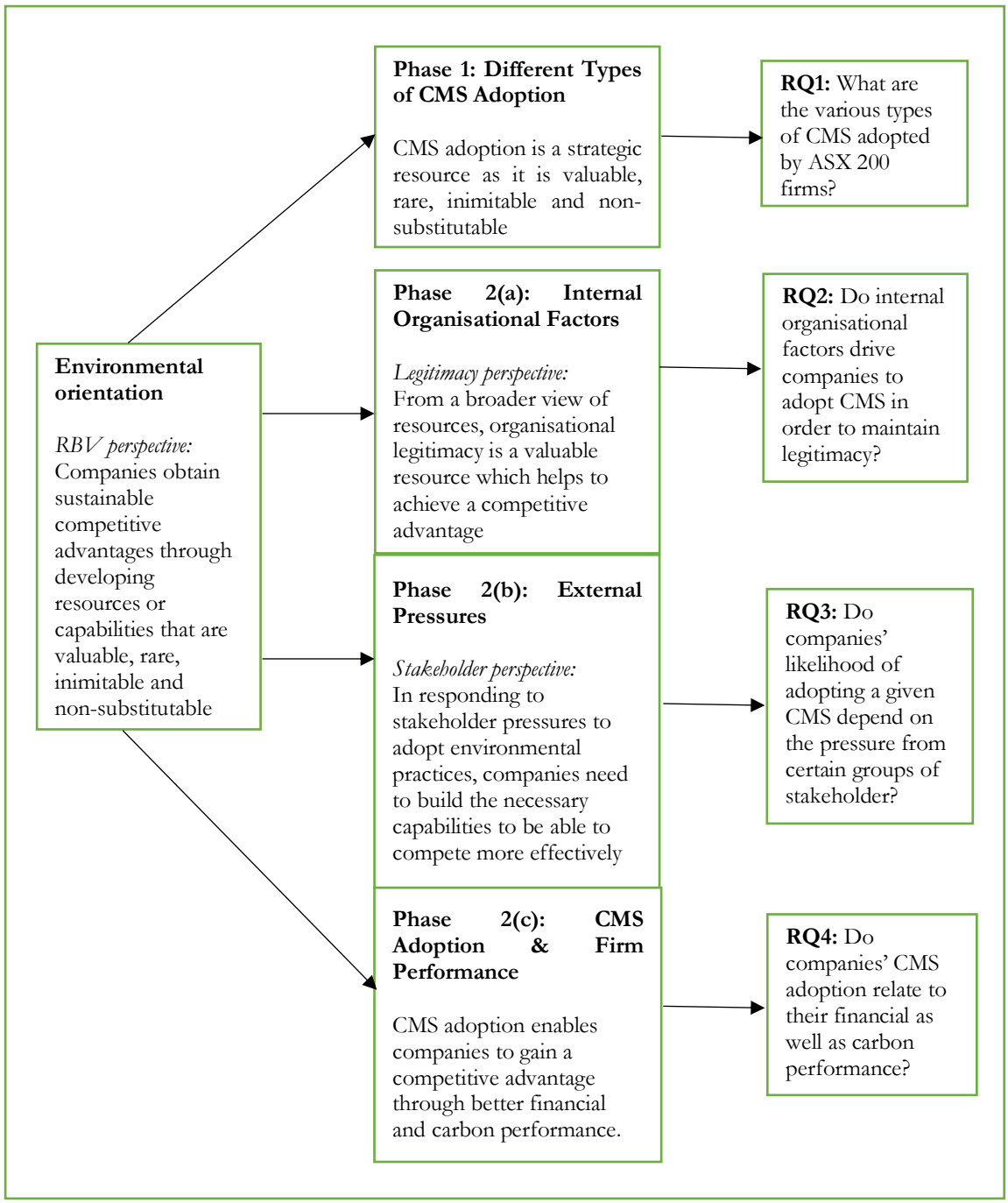
theoretical context to evaluate the relationship between stakeholder pressure and CMS adoption.

## 2.8 CONCEPTUAL FRAMEWORK UNDERPINNING THE RESEARCH

As climate change is increasingly viewed as a strategic issue, academics are starting to explore the role of dynamic capabilities in firms' responses to climate-induced changes to their business environment (Kolk & Pinkse, 2004, 2008a, 2008b). It is progressively recognised that climate-related risks and opportunities involve a different set of dynamic capabilities than strategies traditionally applied to manage environmental issues (Lash & Wellington, 2007; Park, 2008). Berkhout et al. (2006) believed that whether a firm is an early or late adopter of climate-related changes depends on its dynamic capabilities – that is, the ability to modify organisational routines and behaviours in response to external drivers of change caused by climate change. Furthermore, Aragon-Correa and Sharma (2003) claimed that the management of climate-induced drivers of change requires the development of complex, dynamic capabilities that link all of the firm's operations through highly developed organisational and managerial processes.

Consequently, firms' CMS adoption is a form of environmental orientation which recognises that the organisation needs to mitigate its carbon emissions and that a proactive corporate stance towards environmental responsibility is an important part of a firm's strategic objectives. In view of this, the proposed conceptual framework of this study is presented in Figure 2.3.

**Figure 2.3: Conceptual framework of this study**



As discussed in Section 2.5, in RBV the identification and possession of internal strategic resources contributes to a firm's ability to create and maintain a competitive advantage and improve performance (Barney, 1991; Hart, 1995; Crook et al., 2008). A resource is considered strategic if it meets certain criteria – valuable, rare, inimitable and non-substitutable – that help to improve the performance of the firm (Barney, 1991; Crook et al., 2008). The valuable criterion refers to the extent to which the resources are aligned with the external environment to exploit opportunities and reduce threats. Resource rareness refers to the perceived scarcity of the resource. Inimitability is the extent to which competitors cannot obtain or replicate the resources, or can only do so at a significant cost disadvantage (Hoskisson, Hitt, Wan & Yiu, 1999). Non-substitutability is the extent to which competitors are unable to create equivalent resources. According to RBV, firms attempt to identify strategic resources that are most likely to make them more competitive in the market, and employ such resources to exploit their value (Sirmon et al., 2007).

The capability to design new products that emit less carbon emissions or improve existing ones so they are carbon-free during their production and use is a valuable strategic resource. Firms that adopt such an approach involving the development of climate-related dynamic capabilities generally enjoy a competitive advantage over firms that have not developed such skills (Porter & Van der Linde, 1995). Thus, CMS adoption through the design of a new product, process or innovative technology could provide the firm with a rare capability and therefore contribute to a competitive advantage.

A successful continuous improvement process in relation to CMS adoption incorporates multiple levels of engagement, from upper management to employees, and can even extend through the supply chain. This also ensures that any company seeking to imitate such a process will not be privy to the social relationships and the deployment of human resources and strategy, which makes it difficult to replicate. Furthermore, CMS adoption generally refers to a firm's commitment to manage its carbon emissions across its business operations, underpinned by a unique combination of resources through which firms develop unique capabilities. Capabilities that are an incremental result of growth via underlying skills and knowledge may relate to innovative products, improving existing processes, investing in energy-efficient projects, and green supply chain management. Specifically, the adoption of CMS provides management with the ability to consolidate

collective learning on environmental issues into unique organisational capabilities and adapt quickly to changing opportunities. Thus, RQ1 of this study is restated as:

RQ1: What are the various types of CMS adopted by ASX 200 firms?

CMS adoption is often seen as an environmental orientation that has two dimensions: (1) internally-focused; and (2) externally-focused. Most proactive companies attempt to manage climate change risks by adopting CMS with company-specific initiatives. These initiatives often involve internal governance responses such as introducing an EMS, establishing an environmental committee, or strengthening corporate governance by increasing the board size and enhancing board independence. Thus, the internally-focused dimension of CMS adoption can be viewed as an attempt by managers to maintain organisational legitimacy. That is, to keep the social contract intact, firms need to convincingly respond in line with the social norms. Furthermore, organisational legitimacy can provide critical societal resources that facilitate and complement financial and physical resources. Thus, the legitimacy perspective complements RBV across three key internal aspects. First, from a broader view of resources, legitimacy is an integral and valuable asset to firms (Barney, 1991; Hall, 1992). Second, legitimacy invites and generates continuous resource supplies from the environment. Third, legitimacy leads to an enhanced strategic position, which is necessary for establishing sustainable competitive advantages (Barney, 1991). Firms that recognise the importance of achieving organisational legitimacy are more likely to proactively manage environmental issues by way of adopting CMS. Thus, RQ2 of this study is:

RQ2: Do internal organisational factors drive companies to adopt CMS in order to maintain legitimacy?

The externally-focused dimension of CMS adoption is mostly related to responding to various stakeholder interests. For example, firms experience a considerable degree of pressure from government, NGOs, and media/general public to account for their carbon impact (Sprengel & Busch, 2011). Many are forced to establish a corporate carbon norm[12] to comply with stakeholder demands and communicate affirmative behaviour towards minimising their future environmental impact. These firms also improve their competitive posture by developing specific capabilities to manage the

[12] A corporate carbon norm is an informal agreement shared across firms to constrain the use of carbon-based resources (Pinkse & Busch, 2013).

conflicting interests of stakeholders (Rueda-Manzanares et al., 2008). Hence in this sense, stakeholder theory complements RBV.

In responding to stakeholder pressures to adopt environmental practices, RBV posits that companies need to build the necessary capabilities to be able to compete more effectively. In line with this, Hart (1995) argued that firms with developed proactive environmental strategies through the use of resources will have a stronger stakeholder awareness. Hence firms are increasingly responding to the perceived rise in environmental consciousness among stakeholders by expanding their selection of products that are less harmful to the environment (Zhu, Sarkis & Lai, 2008). Furthermore, the more salient the stakeholder, the more prepared the company must be to adapt to meet their expectations. That is, firms need to take actions in order to fulfil the expectations of particular stakeholders who have the power, legitimacy and urgency to impact on their performance (Mitchell et al., 1997). Firms that recognise the stronger stakeholder focus are likely to adopt CMS to demonstrate that they are complying with their stakeholder expectations. Thus, the following RQ3 was formed in this study:

> RQ3: Do companies' likelihood of adopting a given CMS depend on the pressure from certain groups of stakeholder?

As mentioned in Section 2.5, RBV helps explain the relationship between a firm's resources and capabilities and competitive advantage. Most organisations are considered dynamic and evolving entities that respond to external pressures according to their internal resources and capabilities (Barney, 1991). The strategy chosen should therefore allow an organisation to best exploit its core competencies relative to opportunities in the external environment. Firms that most effectively manage their resources to differentiate themselves can gain a competitive advantage and potentially improve the financial performance of the firm (Zott 2003).

In relation to climate change, carbon norms could contribute to a competitive benefit as it is considered as differentiation strategy (Pinkse & Busch, 2013). Firms often use a carbon norm to signal the low-carbon nature of their products and services to prospective customers who are willing to pay a premium price in return. Given the general public's awareness and interest in climate change, firms have the potential to develop low-carbon products and services that would differentiate them from competitors (Schultz &

Williamson, 2005). The ultimate result of these efforts is to reduce pollution and hence to achieve better carbon performance. Consequently, carbon emissions management can provide a number of potential opportunities to increase revenue, such as increased access to other markets, and enhanced ability to offer differentiated products and to sell pollution-control technology (Ambec & Lanoie, 2008). In addition, it also highlights possible opportunities to reduce expenses including costs of material, energy and services, cost of capital, and cost of labour.

Thus, the development of organisational capabilities through CMS adoption is likely to lead to better financial as well as carbon performance, which also helps firms to stay a step ahead of their competitors. Consequently, RQ4 in this study is:

RQ4: Do companies' CMS adoption relate to their financial as well as carbon performance?

In conclusion, this study's review of theoretical literature shows that legitimacy theory and stakeholder theory have been used by various researchers to explain how the social and environmental practices of organisations are used to respond to pressures exerted by various stakeholder groups. In addition to these two common theories, another theory that is widely used in strategic management literature is RBV. An extensive array of scholars has investigated the environmental management practices through the theoretical lens of RBV. Such studies have unpacked the most common organisational resources and capabilities that link environmental strategy and organisational performance.

These three theories should not be considered as sharply distinct, but instead providing complementary perspectives in relation to environmental management studies. All three theories see the organisation as part of a broader social system that influences and is influenced by the expectations of other parties within that social system. A combination of these three theories is therefore required to provide an in-depth understanding of different types of CMS adoption in response to various social and environmental pressures and how CMS adoption impact on financial and carbon performance.

## 2.9 CHAPTER SUMMARY

This chapter provides an overview of theoretical perspectives commonly used in the social and environmental accounting literature, and also introduces the conceptual framework that is used in this research. Having justified the use of theoretical perspectives, Chapter 3 next reviews the literature in detail and develops specific hypotheses.

# CHAPTER 3

# LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

## 3.1 INTRODUCTION

This chapter reviews the academic literature related to the four RQs raised in Chapter 1 on CMS adoption. Its objective is to provide an understanding of the research on which the relevant hypotheses have been developed. This chapter is structured as follows. Section 3.2 discusses previous carbon studies and relevant research on the climate change phenomenon. Section 3.3 reviews related literature on possible internal drivers of CMS adoption. From this review, the specific hypotheses relating to RQ2 have been developed. Section 3.4 presents the existing literature on stakeholder pressure and CMS adoption. From this discussion, three specific hypotheses are formulated to address RQ3. The next Section 3.5 then reviews existing literature on the relationship between firm performance and CMS adoption. From this review, the specific hypotheses relating to RQ4 have been developed. Lastly, Section 3.6 presents a summary of this chapter with a list of hypotheses corresponding to the four RQs.

## 3.2 CLIMATE CHANGE AND CARBON LITERATURE

People in general, government[13] and other social groups have become increasingly interested in knowing more about the effects of business on society and the environment in particular (Ranchhod & Park, 2004; Organisation for Economic Co-operation and Development, 2007; Mason, 2008). Thus, businesses are experiencing growing pressure to disclose their impacts on both society and the environment (Shying & Wong, 2007; Simnett, Nugent & Huggins, 2009b). In recent years, environmental issues such as global warming and climate change have had a substantially damaging effect on the global

[13] In this thesis, the word 'government' is used interchangeably with 'regulator'.

economy and ecological systems (Garnaut, 2011); thus, climate change and consequently carbon emission mitigation has become one of the most pressing issues in the field of corporate social and environmental responsibilities (Kolk & Pinkse, 2007; Stern, 2008).

From a business perspective, corporate attitudes towards climate change have significantly shifted over around the mid-1990s (Kolk, Levy & Pinkse, 2008). At the beginning of the 1990s, businesses still generally ignored or concealed issues relating to climate change (Haque & Deegan, 2010). Since then, common business objectives have changed focus from shareholder satisfaction alone to the mutual benefits of both society and business. Therefore, an increasing number of climate change issues and corresponding business strategies have been brought into light by businesses (Kolk et al., 2008; Kolk & Pinkse, 2008b). Many firms now realise that by mitigating exposure to climate change risks while also seeking new opportunities for profit, a competitive advantage can be obtained (Lash & Wellington, 2007; Porter & Reinhardt, 2007).

The notion of viewing the management of carbon emissions from a strategic management perspective is a relatively new area of research. The following three sub-sections discuss the prior limited research on GHG disclosure and carbon emissions management.

### 3.2.1 GHG or carbon emissions disclosure studies

Most of the prior studies have identified that regardless of the risks posed by climate change, S&P firms provide limited information about carbon emissions and related climate change impact (Doran & Quinn, 2009; Stanny, 2010). Kolk et al. (2008) found that even though there is an increasing trend of response to the annual CDP surveys, most information fails to meet the expectations of investors, NGOs and policymakers. Therefore, this paucity of carbon- and climate-change-related information has driven some researchers to explore the forces motivating such disclosures.

With regard to carbon disclosure behaviour, large firms from Kyoto Protocol ratifying countries are more inclined to reveal information in general than their counterparts from non-ratifying nations (Freedman & Jaggi, 2011). Furthermore, the practice of multinational companies regarding the disclosure of pollution information often varies, depending on the location of their branches or home office (Freedman &

Jaggi, 2011). Other factors that commonly influence disclosure of GHG emissions include firm size, previous participation in the CDP questionnaire, cross-listed position, and the presence of projected disclosure laws in the relevant country (Prado-Lorenzo, Rodriguez-Dominguez, Gallego-Alvarez & Garcia-Sanchez, 2009). Luo, Lan and Tang (2012) analysed a broader set of variables that incentivise management to disclose carbon information. Their results indicate that firms face increasing pressures from external stakeholders to make such public disclosures.

A more recent study by Liesen, Hoepner, Patten and Figge (2015) sought to shed further light on the practice of incomplete corporate disclosure of GHG emissions, investigating whether external stakeholder pressure influences the existence and extent of voluntary GHG emissions disclosures. While their findings also identified external stakeholder pressure as a determinant of the existence of public disclosure, it did not appear to influence how much was disclosed. These findings are consistent with stakeholder theory premise that companies respond to external stakeholder pressures to report GHG emissions, but also with legitimacy theory premise that firms can use carbon disclosure – in this case the incomplete reporting of emissions – as a symbolic act to address organisational legitimacy.

### 3.2.2 GHG emissions disclosure studies based on CDP survey

The CDP is an independent non-profit global entity that facilitates the collection of emission-related data for institutional investors via firms responding to a questionnaire. In relation to GHG emissions disclosure via this method, Kolk et al. (2008) examined the rate of response to the CDP questionnaire and the type of information disclosed. They found that the rate of response in 2007 was high, at 77% of *Financial Times* Global 500 (FT 500) companies. Despite this high response rate, deeper analysis of CDP disclosures found that a lack of disclosure in relation to the type of emissions data reported can make it difficult even for experienced climate change analysts to accurately interpret the information provided.

In relation to CDP survey, Pinkse and Kolk (2009) found that some companies are not transparent with regard to the methodology used to calculate emissions and targets, while others vary their methodologies, thereby hampering any comparative or trend analysis. Sullivan, Crossley and Kozak (2008) also highlighted that some companies

do not clearly describe how they treat emissions from their subsidiaries, and do not include total operations when creating emissions inventories.

Furthermore, Stanny and Ely (2008) and Stanny (2010) investigated the determinants of disclosure by firms via their responses to CDP survey. The factors they considered were company size, FT 500 membership, previous CDP disclosure, foreign sales, institutional ownership, industry, asset age, capital expenditures, leverage, Tobin's Q (a financial market-based measure of firm performance) and profitability. The results indicated that larger firms and those with FT 500 membership which meant they were already exposed to CDP are more likely to disclose. In line with this, a firm that responded in the previous year was more likely to respond in the subsequent year. They also found a positive association between the degree of foreign sales and disclosure, suggesting that global firms have greater incentives to disclose due to a higher degree of environmental regulation and scrutiny. Overall, their findings suggest that the greater the degree of scrutiny placed on firms by institutional investors, the more likely it is that the firms provide a more detailed response to the request for climate change information by institutional investors. Although, the study by Stanny (2010) found that the response rate was high in the CDP survey, the depth of information on carbon emission and strategies used in dealing with climate change was low. This disclosure behaviour is interpreted as supportive to legitimacy theory.

Another CDP-related study by Cotter and Najah (2012) suggested that a powerful stakeholder coalition of institutional investors can influence corporate reporting for large companies in particular. They also identified the following three indicators of corporate responsiveness to institutional investors: (1) completion and publication of the CDP questionnaire on the CDP's website; (2) indications in corporate communications that CDP activities have influenced climate change disclosures; (3) and the extent and quality of climate change information provided in CDP questionnaire responses.

In the study conducted by Peters and Romi (2009), differences in CDP responses were examined across 28 countries. According to their results, the level of disclosure in CDP survey is mostly associated with the environmental regulatory stringency of the government, the environmental responsiveness of the private sector, and the market structure of each country. In another study by Reid and Toffel (2009) which investigated

corporate responses to CDP survey of S&P's 500 companies, it was suggested that companies in environmentally-sensitive industries are often targeted by shareholder demands on environmental issues. Furthermore, they found that companies operating under carbon emission trading laws, or in countries that are going to issue new emissions constraint laws are more likely to publicly disclose emissions information than their overseas counterparts.

Using a sample of 2,045 large firms from 15 countries, Luo, Tang and Lan (2013) examined the influence of economic, regulatory, social and financial market factors on voluntary disclosure of GHG emissions information to the CDP. Their findings indicated that such disclosures are often associated with company size, sector carbon intensity and country of origin characteristics (i.e. whether the country has an ETS and/or operates under common law). They also found that leverage is not linked to GHG emissions disclosure to CDP. They therefore concluded that pressures from people in general and the government in particular the main motivating forces behind climate change disclosure, rather than other major stakeholders such as shareholders and debtholders.

A more recent study by Luo and Tang (2016) investigated the quality of a company's carbon management system and its determinants using a sample of 1805 firm-year observation that participated in the CDP in 2011 and 2012. Their results showed that overall quality of carbon management system improved during the research period. They also documented positive effects of existence of ETS in the country along with competitive pressure, code law countries and level of carbon exposure. They concluded that external (ETS, competitor and code law) and internal (carbon intensity and shareholder) forces shape the way in which firms respond to climate change to reduce compliance cost or manage stakeholder relationships.

### 3.2.3 GHG emissions disclosure studies in the Australian context

In the Australian context, Simnett and Nugent (2007) reported low levels of carbon emission disclosure in their examination of 2005 annual/sustainability reports of 1,485 ASX-listed companies. Since the period covered was pre-NGER Act, they took this as proof that companies cannot be relied on to make voluntary disclosures. Furthermore, Haque and Deegan (2010) examined climate-change-related corporate governance

disclosures of five ASX companies from 1992 to 2007. In their study, they found an increasing trend in companies' climate-change-related disclosure over the period being attributable to growing public pressure and global policy.

Given an absence of a government mandate on disclosing GHG at the time of research, Rankin et al. (2011) sought to understand individual corporate choices in relation to voluntarily GHG emissions reporting. The authors used institutional governance systems theory (Griffiths & Zammuto, 2005; Griffiths et al., 2007) to develop an understanding of GHG emissions disclosure of ASX300 Australian companies. Accordingly, they hypothesised that internal organisational systems and private regulation in such forms as of Global Reporting Initiative (GRI) guidance and CDP survey influence the decision to report, and further affect the extent and credibility of reporting. The results showed that disclosing firms were more likely to have implemented EMSs, possess stronger governance systems, to have made CDP disclosures publicly available, to be larger in size, and operating within the energy and mining or industrial sector (i.e. environmentally sensitive industries) Furthermore, as an attempt to ensure the extent and credibility of disclosures, such firms were more likely to have an International Organization for Standardization (ISO) 14001 certified EMS, use GRI guidelines to make sustainability disclosures, and make their CDP disclosure publicly available.

Using legitimacy theory, Cowan and Deegan (2011) suggested that organisations tactically use annual reports to communicate to society their response to Australia's National Pollutant Inventory[14]. They argued that actual environmental regulation is likely to act as a driver of change in the environmental disclosure practices of Australian companies, although not as a direct result of a specific requirement of that regulation.

The studies by Lodhia (2011) and Lodhia and Martin (2011) both took as a starting point the introduction of government policy on reporting of GHG emissions in Australia. The purpose of Lodhia's (2011) study was to draw out the accounting implications of the NGER Act 2007 in Australia. He suggested that accounting researchers, especially those

[14] The NPI was the first national environmental protection measure to be established and implemented by the National Environment Protection Council (NEPC). The NPI has been described as designed to provide the community, industry and government with information on the types and amounts of chemicals discharged into the air, land and water (Hill, 2000). The implementation period comprised two voluntary reporting periods and a mandatory reporting period, commencing 1 July 1998 in which companies reported on 36 of the potential 90 reportable substances (Cowan & Deegan, 2011).

with interests in social and environmental issues, had a critical role to play in highlighting the potential of the accounting practice in managing, and providing accountability over, carbon emissions. Using agenda-setting framework as a theoretical lens, Lodhia and Martin (2011) analysed Australian Government policy development on the reporting of GHG emissions. They assessed government submissions by a range of stakeholders following consultation on the NGER Act policy paper. The submissions were from companies, industry groups, environmental groups, consultants, private citizens, government departments and business enterprises, and standards groups. They found a divergence in the responses of corporations and other stakeholders, with the former focusing primarily on the NGER policy paper, while the latter presented significant concerns over carbon pollution and climate change, an issue that was not the primary concern of the policy paper. Moreover, corporations also acknowledged the close link between the NGER process and a future emissions trading scheme, and expressed concerns over the development of a mechanism that would put a price on carbon.

Although based on a small sample of ASX-Top50 companies, Hrasky (2012) assessed whether carbon-footprint-related disclosures by Australian companies are more reflective of symbolism (pragmatic legitimation), or of apparent behaviour (moral legitimation). Pragmatic legitimacy is founded on the societal acceptability of organisational behaviour and involves direct interactions between the organisations and their stakeholders, and thus depends on impression management to a large extent (Hrasky, 2012). In contrast, moral legitimacy is based on moral justification of business activities. She found evidence of both types of legitimation tactics following content analysis of reports issued by the ASX's top 50 companies; however, the tendency of more versus less carbon-intensive organisations were different. That is, companies in the materials and industrial sectors (i.e. carbon-intensive sectors) appeared to be pursuing a moral legitimation strategy underpinned by substantive action while other companies such as those in the financial sector (i.e. non-carbon-intensive sector) were relying more heavily on symbolic disclosure. Hrasky (2012) therefore argued that voluntary actions to reduce carbon impacts are not generally producing the desired outcome, at least in the short term.

While previous studies provided various explanations of Australian companies' emission reporting practices, they were based on a period prior to the widespread public discussion and interest in climate change and carbon emissions. Since the introduction in

mid-2007 of a mandatory reporting system, the NGER Act, there had been a significant increase in public awareness of climate change and carbon emissions. Such changes in social and regulatory environments provided an opportunity to investigate how Australian companies had reacted to those changes. The study by Choi, Lee and Psaros (2013) examined the practices of Australian companies in reporting their carbon emissions and policies related to such emissions during the years 2006-2008. They found that the number of Australian companies providing voluntary carbon disclosures had increased substantially during this period. Furthermore, the results showed that larger firms with higher visibility tend to make more comprehensive carbon disclosures. Overall, their results indicated that the legislation of the NGER Act in 2007 may have enhanced the voluntary carbon emission disclosures in 2008, even though the NGER Act was not operative until the 2009 financial year.

There appears to be an urgent need for research on incentives that encourage actual mitigation of the effects of climate change among business entities. In line with this, a recent study by Haque and Islam (2015) investigated stakeholder pressures on corporate climate-change-related accountability and disclosure practices in Australia. They found that while NGOs and the media have some influence, institutional investors and government bodies (regulators) are the most powerful stakeholders in creating climate-change-related concerns and placing coercive pressure on corporations to be accountable. However, their study also identified a significant role among non-financial stakeholders (i.e. the joint actions of non-shareholding stakeholder groups and news media) in influencing climate-change-related disclosure practices.

In summary, the findings on GHG emission disclosures to date demonstrate consistency with those of earlier studies on voluntary environmental disclosures, whereby shifting disclosure practices are reflective of increasing public pressures (Guthrie & Parker, 1989) and community concerns (Deegan et al., 2002). However, prior studies examining GHG emissions disclosures have either been in the context of corporate governance disclosures (e.g. Haque & Deegan, 2010), disclosure to the CDP (e.g. Stanny & Ely, 2008; Cotter & Najah, 2012; Luo, Tang & Lan, 2013), internal organisation systems factors (e.g. Rankin et al., 2011), or the use of GRI (e.g. Prado-Lorenzo et al., 2009). Although there is an increasing awareness of climate-change-related risks to businesses, studies examining firms' response to carbon emissions mitigation and drivers of CMS

adoption are still scarce. To date, there has been no study that specifically investigates the relationships between a firm's decision to adopt CMS and internal organisational and governance factors. The following section therefore examines each of these relationships by revisiting relevant theoretical perspectives and climate change literature to develop the hypotheses in this study.

## 3.3 INTERNAL DRIVERS OF CMS ADOPTION

In the field of accounting research, the concept of legitimacy has gained prominence in explaining the importance of social influences on corporate strategic decisions (Ingram & Silverman, 2002). Legitimacy has therefore played a significant role in exploring what drives proactive corporate environmental initiatives and practices (Jennings & Zandbergen, 1995; Delmas & Toffel, 2004; Hahn & Scheermesser, 2006). In the area of corporate environmental management, legitimacy theory has surfaced in two discourses. First, legitimacy theory is useful to elaborate the development of firms' ecological sustainability. Relevant studies have focused on the process of firms' institutionalisation in response to environmental issues (e.g. Jennings & Zandbergen, 1995; Hoffman, 2001). Second, in explaining why firms want to achieve organisational legitimacy, the source of institutional pressures for environmental initiatives have been explored (e.g. Khanna & Anton, 2002; Delmas & Toffel, 2004; Darnall, 2006).

As identified in Section 2.6.1, legitimacy is often a significant organisational resource upon which the organisation depends for survival (Ogden & Clarke, 2005). Furthermore, legitimacy can lead to an enhanced strategic position and is necessary for establishing sustainable competitive advantages (Lin, Yang & Arya, 2009). The need for legitimacy is often seen as a force that drives organisations to adopt socially-appropriate practices and goals (Meyer & Rowan, 1977).

One suggested way to achieve organisational legitimacy is to create formal structures to manage environmental issues like climate change. In the context of carbon management, these structures may require a dedicated board, team or individual that is responsible for GHG mitigation. For instance, some firms create climate change governance boards at the executive level (Carbon Disclosure Project, 2012). Other firms take a more decentralised approach by developing taskforce teams or associates who promote cross-functional cooperation. Most firms are better able to communicate their

proactive efforts towards carbon reductions to gain legitimacy. Furthermore, the structure itself is perceived as legitimate, because its existence reflects the firm's initiatives for carbon emission mitigation. Hence, the presence of a climate change governance structure improves a firm's reputation among external stakeholders.

In relation to this, most companies proactively attempt to manage climate change risks by adopting CMS and developing specific initiatives. These initiatives include internal governance mechanisms such as introducing an EMS, establishing an environmental committee, or strengthening corporate governance (e.g. by increasing the board size and enhancing board independence). This study has therefore examined the internal organisational factors that are considered as possible drivers of CMS adoption by ASX 200 firms. However, due to limited prior research on specific CMS drivers, this section provides an overview of the environmental management literature which most closely aligns with the major focus of this study.

### 3.3.1 Environmental management system (EMS)

Implementing an EMS signifies organisations' recognition of interaction between their activities and the environment, a typology of environmental impacts emanating from different operations, and a commitment to implementing potential to prevent environmental pollution and natural resource degradation (Rondinelli & Berry, 2000). Common components of EMSs include the implementation of written environmental policy, training of employees on environmental concerns, commissioning of internal environmental audits, and the formulation of environmental performance indicators and goals (Tan 2005). Despite most often being a voluntary initiative, the adoption of an EMS creates opportunities to improve corporate processes, products and services, which may then lead to cost savings and enhanced profitability (Coglianese & Nash, 2001). An EMS can assist firms in minimising GHG emissions via efficient practices of energy usage including offsetting these emissions to achieve carbon neutrality.

Various environmental management researchers have evaluated what motivates companies to adopt an EMS (e.g. Melnyk, Sroufe & Calantone, 2003; Anton, Deltas & Khanna, 2004; King, Lenox & Terlaak, 2005; Potoski & Prakash, 2005a), and the relationship between EMS adoption and environmental performance improvement (e.g. Melnyk et al., 2003; Anandale, Morrison-Saunders & Bouoma, 2004; Potoski & Prakash,

2005b; Darnall, Henriques & Sadorsky, 2008; Montiel & Husted, 2009). Rankin et al. (2011) argued that firms with an EMS present more credible GHG information than those without. Indeed, it appeals to intuition that firms with an EMS are more likely to be in a superior position to address business risks associated with climate change, and thereby more likely to appear legitimate. The establishment of an EMS helps to minimise or eliminate waste, reduce energy consumption, and decrease the firm's adverse impact on the environment (Melnyk et al., 2003). Therefore, an EMS has the potential to assist enterprises in facilitating cleaner production as well as better management of carbon emissions (Thornton & Hsu, 2001; Rankin et al., 2011).

Given that legitimacy motives drive voluntary EMS adoption in most firms, it is conceivable that firms with an EMS would be more likely to also adopt CMS. Hence, EMS implementation demonstrates that their behaviour is congruent with the expectations of society. Thus, in line with legitimacy theory and this study's RQ2, the following hypothesis is put forward:

*H1A: Firms that have voluntarily established an EMS are more likely to adopt CMS than those firms without an EMS.*

### 3.3.2 Environmental committee

An environmental committee within an organisation is generally set up to drive the systematic planning, implementation and review of sustainability policies and activities. The presence of such a committee often enhances a firm's environmental reputation, particularly in the eyes of influential external stakeholders (Neu, Warsame & Pedwell, 1998; Anandale et al., 2004). It also reflects proactive corporate governance, directing the organisational long-term strategy towards a low-carbon economy (Rankin et al., 2011). In line with this, Michals (2009) suggested that firms that entitle specific committees of the board to deal with environmental issues are more considerate of the various perspectives of risks, strategic opportunities and commitments among influential stakeholders.

It has also been suggested that as most firms' management are hesitant to disclose environmental information, the board and its subcommittees play a vital role in actively monitoring the legitimacy of the firm's environmental practices (Liao, Luo & Tang, 2015). The members of the environmental committee are more likely to fairly evaluate the pros

and cons of carbon-neutral initiatives to lessen fossil fuel combustion and motivate investments in feasible abatement projects and carbon-free products (Dietz, Hope, Stern & Zhengelis, 2007).

Furthermore, an environmental committee helps to enrich the awareness of employees in regards to the environmental aspects. Such committees usually set up both aspiring targets and monetary and non-financial rewards (Dietz et al., 2007). As a result, the firm's staff members are motivated to make necessary changes that advance the adaptability of the organisation. Thus, an environmental committee can be seen as a proxy for board orientation towards environmental accountability (Neu et al., 1998). A recent study by Liao et al. (2015) found that the existence of an environmental committee also influences the voluntary disclosure of GHG emissions.

Other than the voluntary disclosure, environmental committees also provide assistance to manage a firm's environmentally-related reputational risk and threats to legitimacy. Thus, it is conceivable that an environmental committee that is driven by legitimacy and reputation management motives would aim to influence a firm to adopt CMS to mitigate carbon emissions. Further, it has been suggested that a firm's environmental committee motivates a firm to implement strategies and practices to measure and report on GHG emission levels (Ashforth & Gibbs, 1990). An environmental committee is likely to promote strategies to improve the firm's carbon performance in order to ensure that the disclosed information does not negatively affect the firm's legitimacy and reputation.

In line with legitimacy theory, organisations are subject to influences from societal and cultural expectations within broader social systems. Organisational conformity to such expectations and norms may result in the establishment of an environmental committee, which in turn enhances the organisation's legitimacy prospect. Thus, the following hypothesis which is also related to RQ2 is formulated:

*H1B: Firms with an environmental committee are more likely to adopt CMS than those firms without such a committee.*

### 3.3.3 Board size

Corporate governance practices are vital in terms of considering the level to which firms proactively address climate change issues (Kiel & Nicholson, 2005). Corporate governance relates to the development of long-term strategy, information disclosure, transparency, and responding to strategic issues like climate change (Galbreath, 2010). Prior studies have attempted to identify corporate governance attributes as determinants of social/environmental disclosure (e.g. Cheng & Courtenay, 2006; Bebbington, Larrinaga & Moneva, 2008; Rao, Tilt & Lester, 2012; Chapple & Truong, 2015). These attributes include board independence (Eng & Mak, 2003), female directors and institutional investors (Kathy et al., 2012), board size, chief executive officer (CEO)/chair duality and non-executive directors (Gul & Leung, 2004), and the presence of a CSR/environmental committee (Michelon & Parbonetti, 2012).

It has been recognised that the board plays a significant role in monitoring managerial actions in line with stakeholder interests (Tauringana & Chithambo, 2015). However, there is no clear idea within the literature about the appropriate board size to perform the duties satisfactorily. The growing consensus is that a large board is more likely to be helpful in providing guidance and advice (De Villiers, Naiker & Van Staden, 2011a). Larger boards are more likely to include more prestigious directors, which increases the board-monitoring capacity (Certo, 2003). In addition, larger boards will provide a varied range of experience and skills, which enables them to perform their duties more efficiently (Tauringana & Chithambo, 2015). Furthermore, different board members represent different interests, including those relating to environmental and GHG emissions issues. In line with this, De Villiers et al. (2011a, p. 1645) believed that larger boards enable wider connections with important stakeholders, meaning that firms with large boards are "likely to facilitate access to critical financial resources, allowing such boards more financial leeway to pursue environmental initiatives".

In relation to GHG emissions reporting, Rankin et al. (2011) documented that firms with a strong governance structure are more proactive in their carbon emissions disclosure strategies. Both Peters and Romi (2012) and Tauringana and Chithambo (2015) found evidence of a significant positive relationship between board size and GHG emissions disclosure. Prior studies (Akhtaruddin, Hossain, Hossain & Yao, 2009; Cormier, Ledoux & Magnan, 2011; Allegrini & Greco, 2013) have also indicated a positive

association between board size and environmental disclosure. Thus, it would appear that firms with a larger number of board members have a stronger inclination to deal with issues relating to carbon emissions by adopting strategies such as CMS to improve corporate image and avoid potential damage to the firm's reputation, and thereby maintain legitimacy. Hence, based on this argument the following hypothesis related to RQ2 is formulated:

*H1C: The higher the number of board members, the greater the likelihood of the firm adopting CMS.*

### 3.3.4 Board independence

It is widely believed that a board with a higher proportion of external directors is more effective in monitoring management (e.g. Liao et al., 2015), especially because they do not directly engage in daily business operations (De Villiers et al., 2011a), and instead hold non-official positions in the organisation (Donnelly & Mulcahy, 2008). It has also been suggested that they have more of a long-term perspective which complements sustainable development, while internal directors are often more focused on short-term performance goals (Johnson & Greening, 1999). Thus, independent directors are able to provide more objective feedback on a firm's operations and performance.

In line with this, Wang and Dewhirst (1992) argued that independent directors have a stronger stakeholder orientation due to their more diverse backgrounds and a lack of financial stake in the firm. This enhances the ability of a board to encompass multiple needs and expectations of the different constituencies– not only the interests of shareholders and embedded executives (Johnson & Greening, 1999; Michelon & Parbonetti, 2012). Thus, the presence of external directors helps to boost the mediating role of the board among different stakeholders, thereby promoting more responsive policies (Haniffa & Cooke, 2005). It can therefore be determined that boards with a higher proportion of external directors possess a greater ability to balance financial and environmental accountabilities.

Taking such assumptions into account with regard to environmental management, the literature also shows that external directors generally direct more knowledge and expertise towards pursuing environmental opportunities and innovations (Liao et al., 2015). Thus, they are often expected to motivate firms to disseminate a wider range of

information to ensure congruence between organisational decisions and societal values and corporate legitimacy (Donnelly & Mulcahy, 2008; Prado-Lorenzo & Garcia-Sanchez, 2010). Thus, the presence of independent directors has commonly been identified as positively related to general voluntary disclosure as well as specific CSR and environmental disclosures (De Villiers et al., 2011a; Liao et al., 2015).

Furthermore, in the context of climate change, even though investment in energy-efficient initiatives may generate long-term economic value for a firm via energy savings and improved environmental image, carbon pollution control is largely considered a social responsibility (Liao et al., 2015). Hence, external directors are more likely to realise the potential of emissions-control projects and resist any management pressure to overlook such opportunities (Cahaya, Porter, Tower & Brown, 2011). They feel free to encourage resource-intensive climate-friendly policies (Liao et al., 2015).

Many of the theoretical arguments and empirical evidence in the literature also suggest that external directors favour mechanisms conducive of undertaking objective accountability processes over interest groups, which should improve a firm's reporting system and lead to a higher level of environmental transparency (Ibrahim, Howard & Angelidis, 2003; Michelon & Parbonetti, 2012). Therefore, firms with more independent directors are more likely to divert resources towards the adoption of CMS to legitimise organisational operations and to demonstrate that their activities are congruent with societal expectations. Based on this argument, the following hypothesis related to RQ2 is put forward:

*H1D: The higher the number of independent board members, the greater the likelihood of the firm adopting CMS.*

## 3.4 STAKEHOLDER PRESSURE AND CMS ADOPTION

### 3.4.1 Stakeholder pressure to corporate environmental management

As discussed in Section 2.7, stakeholder pressures generate significant motivation for companies to adopt a variety of environmental practices (Buysse & Verbeke, 2003; Eesley & Lenox, 2006). However, due to limited resources, it is not possible for companies to satisfy the interests of every stakeholder. Hence, in line with stakeholder theory, it is important to prioritise stakeholder's interests and classify stakeholders' demands according to their salience. Stakeholder salience is commonly considered to be

on a continuum with highest stakeholder salience, existing when all three of the stakeholder attributes (power, legitimacy and urgency) are perceived by managers to be present (Mitchell et al., 1997).

Previous research shows that specific stakeholder groups influence corporate social and environmental disclosure. For instance, Roberts (1992) identified companies' in high-profile industries – his proxy for stakeholder pressure from the public – as positively associated with the extensiveness of social and environmental disclosure via annual reports in the United States. Focusing on a different source of exposure, Freedman and Jaggi (2005) argued that regulatory pressures from the state induce greater disclosure, with companies from countries that have ratified the Kyoto Protocol reporting more detail in relation to addressing climate change issues. Likewise, Reid and Toffel (2009) found that companies' participation in the CDP is positively associated with greater state-level pressure regarding climate change concerns. Additionally, Deegan and Blomquist (2006) documented that pressures on Australian mining companies via the publication of an environmental scorecard by NGO World Wildlife Fund leveraged changes in their environmental disclosures.

Given the importance of reducing GHG emissions to address climate change, it is not surprising that corporations are being subjected to specific stakeholder pressures for information specifically relating to carbon emissions. Indeed, Kolk et al. (2008, pp. 720-721) stressed that "business is under increasing pressure from investors and environmental non-government organisations to disclose information related to their GHG emissions". With respect to high-profile corporate environmental management such as the Principles for Responsible Investment Initiative (PRI Initiative)[15], the Carbon Principles Banks[16] and the CDP all illustrate the importance of corporate climate change performance to investors. Environmental non-government organisations (ENGOs) also play a major role in the climate change debate and influence corporate actions on climate

[15] The PRI Initiative is a partnership between the United Nations and global investors, with the goal of promoting and mainstreaming responsible investment practice. Launched in 2006 by UN Environment Programme Finance Initiative and the UN Global Compact, the PRI Initiative has become the leading network for investors to learn and collaborate to fulfil their commitments to responsible ownership and long-term, sustainable returns (United Nations Principles, 2012).

[16] The Carbon Principles Banks are a series of guidelines established by three leading Wall Street banks – Citigroup Inc., JP Morgan Chase, and Morgan Stanley – to assess the risks in financing electric power projects in terms of climate change. These principles call for enhanced diligence in evaluating electric power industry borrowers in terms of their use of energy efficiency; renewable and low-carbon distributed energy technologies; and conventional and advanced generating technologies (Energy Efficiency and Renewal Energy, 2008).

change (Gough & Shackley, 2001). In addition, as identified by both Freedman and Jaggi (2005) and Reid and Toffel (2009), governments also exert pressures on corporations for information on GHG performance, at least in part because society continues to be concerned with climate change issues (Kolk et al., 2008). Overall, there is a considerable amount of social and environmental accounting literature indicating that specific stakeholder groups influence corporate disclosure choice.

The literature also provides empirical evidence of how pressure from particular stakeholders affects firms' environmental strategy adoption. In some cases, it suggests that firms design a proactive environmental strategy in an attempt to respond to the stakeholder groups they believe is the most important (Henriques & Sadorsky, 1999; Buysse & Verbeke, 2003; Sharma & Henriques, 2005; Kassinis & Vafeas, 2006; Huang & Kung, 2010). Such a company is therefore coerced by its most influential stakeholders into adopting particular practices, including carbon emissions management practices.

### 3.4.2 Classification of salient stakeholders

Research on stakeholder pressure from an environmental management perspective has included identifying who salient stakeholders are (Henriques & Sadorsky, 1999; Buysse & Verbeke, 2003; Gago & Antolin, 2004; González-Benito & González-Benito, 2006; Eesley & Lenox, 2006; Murillo-Luna et al., 2008), what actions and responses firms should take in response to stakeholder demands (Hart, 1995; Christmann, 2000; Harvey & Schaefer, 2001; Buysse & Verbeke, 2003), and what external factors most influence stakeholder pressure (Rueda-Manzanares et al., 2008; Plaza-Ubeda, Brurgos-Jimenez, Vazquez & Liston-heyes, 2009; Gonzalez-Benito & Gonzalez-Benito, 2010; Sarkis, Gonzalez-Torre & Adenso-Diaz, 2010). In their efforts to identify who the salient stakeholders are, Gago and Antolin (2004) explored stakeholder salience in corporate environmental strategy by examining how the power, legitimacy and urgency of stakeholders influenced the degree of perceived environmental salience among managers in Spanish manufacturing firms. Their results identified government stakeholders as the most salient stakeholders. Furthermore, of the 10 stakeholder groups they examined – government, owners, customers, local community, employees, global community and future generations, business associations, environmentalist groups, mass media, and suppliers – the ranking of the most salient to the least salient stakeholders corresponded with the sequence of the most powerful to the least powerful stakeholders, with the

exception of employees and global community and future generations which were reversed.

In a similar study, Henriques and Sardosky (1999) classified salient stakeholders as regulatory stakeholders (governments, trade associations, informal networks, and leading firms in environmental matters); organisational stakeholders (customers, suppliers, employees and shareholders); community stakeholders (community groups, environmental organisations and other potential lobbies); and the media. In another effort to empirically classify stakeholders into salient groups, Buysse and Verbeke (2003) examined 14 potential stakeholder groups through principal components analysis (PCA), which then regrouped the stakeholders into the following four categories: (1) external primary stakeholders which include domestic customers, international customers, domestic suppliers and international suppliers; (2) secondary stakeholders such as domestic rivals, international rivals, international agreements, ENGOs and media; (3) internal primary stakeholders including employees, shareholders and financial institutions; and (4) regulatory stakeholders such as national governments and local public agencies.

Gonzalez-Benito and Gonzalez-Benito (2006) also utilised PCA in relation to identifying salient stakeholders and derived two groups of salient stakeholders: (1) non-governmental stakeholders which include customers/consumers, suppliers, employee/unions, shareholders, financial institutions, communities and social groups, NGOs, competitors, and media; and (2) governmental stakeholders such as governments and regulatory agents. Based on PCA, Murrillo-Luna et al. (2008) empirically grouped stakeholders into the following five classifications: (1) corporate government stakeholders; (2) internal economic stakeholders; (3) external economic stakeholders; (4) regulatory stakeholders; and (5) social external stakeholders.

Table 3.1 provides an overview of the classification of salient stakeholders as described by the various authors mentioned above.

**Table 3.1: Classification of salient stakeholders**

| **Henriques and Sadorsky (1999)** | | | |
|---|---|---|---|
| Regulatory stakeholders | Organisational stakeholders | Community stakeholders | Media |
| Governments<br>Trade associations<br>Informal networks<br>Leading firms in environmental matters | Customers<br>Suppliers<br>Employees<br>Shareholders | Community groups<br>Environmental organisations<br>Other potential lobbies | media |
| **Buysse and Verbeke (2003)** | | | |
| Regulatory stakeholders | External primary stakeholders | Internal primary stakeholders | Secondary stakeholders |
| National (and regional) governments<br>Local public agencies | Domestic customers<br>International customers<br>Domestic suppliers<br>International suppliers | Employees<br>Shareholders<br>Financial Institutions | Domestic rivals<br>International rivals<br>International agreements<br>ENGOs<br>Media |
| **Gonzalez-Benito and Gonzalez-Benito (2006)** | | | |
| Non-governmental stakeholders | | Governmental stakeholders | |
| Customers/consumers, suppliers, employees/unions, shareholders, financial institutions, communities and social groups, non-governmental organisations, competitors, and media | | Governments<br>Regulatory agents | |
| **Classification by Murillo-Luna et al. (2008)** | | | |
| Corporate government stakeholders | Internal economic stakeholders | External economic stakeholders | Regulatory stakeholders | Social external stakeholders |

In consideration of the above social and environmental accounting literature that has been discussed, this study has made a distinction among three key groups of salient stakeholder representatives in developing the relevant hypotheses for RQ3. These representative stakeholder groups are: (1) regulatory stakeholder pressure; (2) primary stakeholder pressure; and (3) secondary stakeholder pressure.

#### *3.4.2.1 Regulatory stakeholder pressure and CMS adoption*

Regulatory bodies and government (Freeman, 1984; Backer, 2007) are the most obvious stakeholders when it comes to environmental issues and are typically associated with coercive pressures (Zhu & Sarkis, 2007). Businesses must comply with environmental regulations or face the threat of regulators imposing legal sanctions, penalties and fines; while failure to yield to regulatory stakeholders also leaves companies vulnerable to individual or class action lawsuits. Such pressure and threat can hurt an organisation's public image and customer relations.

The main regulatory stakeholders are governments which promulgate environmental regulations; trade associations which collect information regarding both current and pending legislation (Kirby, 1988); and informal networks which are important sources of technological information (Schrader, 1991; Porter & Van der Linde, 1995). Non-government regulatory stakeholders also have the ability to convince governments to standardise an environmental practice or technology (Barrett, 1992); they set and influence the regulatory framework in which all firms must exist (Roome, 1992).

Stakeholder pressure to reduce GHG emissions has almost exclusively stemmed from regional, national and subnational regulators in the form of climate change protocol (Sprengel & Busch, 2011). This focus is substantially aligned with the introduction of carbon trading mechanisms and carbon tax regulations. These increasing environmental regulations have seemingly increased pressure on companies to adopting corporate strategies related to climate change (Sprengel & Busch, 2011). Failure to do so could cost a company its legitimacy. On a regional level, the most prominent example is the EU-ETS[17], which limits the output of carbon emissions in Europe by requiring participating companies to reduce an emissions allowance for each ton of carbon they emit. If such companies plan to emit more than the allowances they have been allocated, they either need to reduce emissions or purchase additional allowances. Consequently, the pressure to reduce carbon emissions increases further, as the allowance price is expected to go up over time.

Another type of climate change regulation is carbon tax, which has been implemented at national and subnational levels in many countries (Okereke, 2007). For example, in Finland, Germany, Italy, Sweden and the United Kingdom, carbon taxes were introduced throughout the 1990s and the early years of the 21st century. Another example of climate change regulation in the Australian context is the *NGER Act 2007*. At the basic level this act facilitates carbon reporting, and it also provides reporting guidelines and associated responsibilities pertaining to carbon emissions (Clean Energy Regulator, 2012). When the required thresholds as specified in the act are met, Australian companies are required to report their GHG emissions to the Clean Energy Regulator, which then

[17] The scheme was the first major GHG emissions trading scheme in the world. It was launched in 2005 to fight global warming and is a major pillar of EU climate policy. As of 2013, the EU-ETS covers more than 11,000 factories, power stations, and other installations with a net heat excess of 20 MW in 31 countries (European Commission, 2014).

releases this information to the general public. These organisations can also proactively disclose this information directly to their stakeholders in a similar way to sustainability reporting, such as aspirational targets to reduce carbon emissions.

In addition, Jennings and Zandbergen (1995) identified that regulatory stakeholder pressure is the key motivating force for companies adopting environmental management practices (EMPs). Other studies have also indicated that collective government regulation, such as in the EU, act as a motivating force for corporations to adopt climate change strategies. For example, Galbreath (2010) contended that regulatory stakeholder pressure drives many firms in EU countries to reveal climate change information in order to gain legitimacy.

As discussed in Section 5.2, compensation strategy is perceived as "transferring emissions or emission-generating activities within the company or to other companies to meet regulatory stakeholder pressure" (Kolk & Pinkse, 2005, p. 9). That is, instead of reducing their own emissions, companies participate in an ETS and are thereby affected by market-based GHG emissions reduction regulation (Sprengel & Busch, 2011). Their potential response is to merely increase the emissions limits by purchasing emissions allowances (Pinkse, 2007; Weinhofer & Hoffmann, 2010). Hence, the adoption of compensation strategy by firms reflects the reactive initiative to mitigate carbon emissions as their carbon management activities might be in the initial stage of setting emission targets. That is, they view CMS adoption as an institutional constraint rather than as an opportunity to obtain a competitive advantage. Buysse and Verbeke (2003) argued that those firms with a reactive strategy attach high importance to government regulation, as an almost mechanistic and routine-driven response to new regulatory requirements. Thus, it is conceivable that firms that adopt compensation strategy are more likely reacting to pressure from regulatory stakeholders.

Conversely, firms that adopt reduction strategy and all-rounder strategy (as discussed in Section 5.2) are likely to have gone beyond what is required by regulatory bodies in an effort to gain a competitive advantage and to maintain organisational legitimacy. Companies with these strategies tend to be leaders in the management of carbon emissions. Most of them voluntarily set carbon reduction targets/investment plans and prepare clear measures to achieve those (Lee, 2012). Companies intending to

reduce emissions within their own organisational boundaries usually follow a process which starts with making an inventory of current emissions, followed by setting up and committing to a reduced emission target. Eventually, specific activities required to reach the target are implemented (Kolk & Pinkse, 2004). In addition, they focus on developing greener and more energy-efficient products.

Most firms with reduction and all-rounder strategy engage in energy-efficient and emission reduction activities in the supply chain as well as in their own production processes (Lee, 2012). For example, they make changes to the organisational culture by improving employee and management awareness of climate change issues. Moreover, they develop external relationship with NGOs and local communities, and hence engage with policymakers to encourage further action on emissions mitigation (Buysse & Verbeke, 2003). Given this, firms with a reduction strategy and all-rounder strategy are more likely to have some influence over the regulatory process; in so doing, they pre-empt rather than react to regulators. Therefore, it appeals to intuition that such firms will receive less pressure from regulatory stakeholders compared to firms adopting compensation strategy. Based on the preceding discussion in relation to regulatory stakeholder pressure, the following hypothesis related to RQ3 is developed:

*H2A: The perceived pressure from regulatory stakeholders is more likely for firms adopting compensation strategy and less likely for firms adopting reduction strategy as well as all-rounder strategy.*

#### *3.4.2.2 Primary stakeholder pressure and CMS adoption*

The primary stakeholder groups are those that maintain formal relationships with the firm, such as employees, shareholders, institutional investors, customers and suppliers. Such formal relationships make primary stakeholders directly relevant to the firm's survival, profitability and growth (Hill & Jones, 1992; Clarkson, 1995). Thus, a company's relationship with its primary stakeholders can be strained due to poor environmental performance.

Primary stakeholders often have an impact on the firm's decision to adopt an environmental strategy. As the executers of environmental strategy, shareholders and employees are identified as the most important stakeholders (Buzzelli, 1991). Shareholders can suffer monetary losses on their investments if a company is found liable for environmental damage or if its poor environmental record makes the news (Nehrt,

1996). Moreover, companies that are known for ineffective environmental management also face difficulty in attracting or retaining highly qualified employees who have a strong preference for proactive environmental management (Reinhardt, 1999). Thus, the company's success in developing proactive environmental management competencies depends on the participation and involvement of its employees and shareholders to a significant extent (Hart, 1995; Sharma & Vredenburg, 1998; Ramus & Steger, 2000).

Institutional investors also represent a powerful and legitimate stakeholder group as they hold large equity positions. They have an incentive to reduce risks by requesting companies to disclose information (Cotter & Najah, 2012). Thus, investor coalitions are a distinctive opportunity to influence and engage corporate management (Clarke & Hebb, 2004; Hebb, 2008). In the context of climate change, CDP can be seen as a primary stakeholder that has assisted collective action by institutional investors in relation to disclosure of emission-related data (Cotter & Najah, 2012).

Customers are another group of primary stakeholders who demand better corporate climate change strategies based on their increasing demand for more environment-friendly products (Business for Social Responsibility, 2007). Numerous companies are therefore acknowledging the significance of climate change because this issue directly affects customers' trust and buying decisions (Bonini et al., 2008). It is clear that corporations need to adopt proper climate change strategies to minimise the 'trust gap' between them and their customers. As such, green consumerism often drives the transition towards more proactive environmental management practices (Arora & Cason, 1995). Some customer groups have exerted negative pressures by boycotting the products of a company with a reputation for poor environmental management (Greeno & Robinson, 1992).

Most companies are part of a larger economic structure formed by supply chains and related networks in which they are embedded. They therefore depend on suppliers for the acquisition of inputs to be used in the production process. Similarly, companies also act as suppliers themselves and provide customers with products and services. The environmental impact of upstream and downstream activities in the supply chain is increasingly being taken into consideration (Florida, 1996; Handfield, Sroufe & Walton, 2005). The impact of suppliers in relation to environmental management has increased

because many companies now focus more on their core competencies while outsourcing other functions (Prahalad & Hamel, 1990). Consequently, companies are considerably dependent on their suppliers for competitive success, while being more vulnerable to environmental and other risks arising from this relationship (Handfield et al., 2005).

With regard to the issue of climate change, companies have two main options when dealing with their suppliers. First, a supply chain strategy can be implemented that focuses on reducing climate change risks by continuously monitoring suppliers' GHG emissions. Hence, an assessment of emissions can be integrated into procurement policies, evaluating supplier bids partly-based on climatic impacts. Second, a company can replace inputs from suppliers with a high potential for GHG emissions by those with lower GHG emissions. A common replacement method is fuel switching; for example, instead of using fossil fuels, companies can start purchasing renewable energy.

As discussed in Section 5.2, firms adopting reduction strategy and all-rounder strategy mainly focus on process improvement and product development (Lee, 2012). In the context of climate change and corresponding process improvements, decreases in firms' GHG emissions are generally related to reductions in their fossil fuel usage, which are typically via improvements to the firm's operating processes (Kolk & Pinkse, 2004). Indeed, modest changes in operating efficiency can lead to significant GHG emissions reductions. Other relevant process improvements also include the use of renewable energies, recycling of materials and recovering of heat waste. In relation to product development to reduce GHG emissions, firms can reuse waste generated in product development or redesign packages to utilise fewer materials and generate less GHG emissions. Significant GHG reductions are typically related to new product development, and the design of new products that use less fossil fuel energy. Relevant examples of low-carbon products include biofuels, biomaterials, and hybrid-engine cars (Kolk & Pinkse, 2004; Hoffman, 2005).

In addition, firms that adopt reduction and all-rounder strategy are more likely to establish better relationships with primary stakeholders. The development of more energy-efficient and less carbon-intensive products will often attract more customers (e.g. customers that prefer energy-efficient appliances) (Kolk & Pinkse, 2004). In addition, by managing carbon emissions effectively through the supply chain, companies can help

reduce their carbon footprint, strengthen their brand image and develop a competitive advantage (Lee, 2011).

In contrast, companies with compensation strategy are unlikely to devote much time or resources to managing primary stakeholder relationships. Their main focus is to respond to the pressure of regulatory stakeholders. In the context of climate change, by participating in ETS, they purchase emissions allowances and hence reduce the pressure from regulatory stakeholders. Furthermore, primary stakeholders are not likely to involve with firms which adopt compensation strategy since they do not claim to be leaders in the area of carbon emissions management. Given this, primary stakeholder pressure to mitigate carbon emissions is not perceived as a threat to the survival of such companies. Based on this notion, it can be expected that firms with compensation strategy will not attach as much importance to primary stakeholder as firms adopting reduction strategy and all-rounder strategy. Thus, the following hypothesis related to RQ3 was articulated:

*H2B: The perceived pressure from primary stakeholders is more likely for firms adopting reduction strategy and all-rounder strategy and less likely for firms adopting compensation strategy*.

#### *3.4.2.3 Secondary stakeholder pressure and CMS adoption*

Secondary stakeholder groups such as community bodies, ENGOs and the media are not generally engaged in formal transactions with the organisation (Florida, 1996; Henriques & Sadorsky, 1999; Buysse & Verbeke, 2003). Thus, only firms that proactively adopt environmental strategies are likely to cooperate with these stakeholders in the development of international environmental standards (Buysse & Verbeke, 2003). This is often detrimental to firms with reactive environmental strategies, as they are less likely to achieve any competitive advantage if proactive environmental management is a business norm among their competitors (Garrod, 1997), or when there are considerable first-mover advantages for early investments in environmental technologies (Nehrt, 1996). Proactive firms may also form strategic alliances with major competitors to address complex environmental problems, or work in close collaboration with ENGOs in their efforts to resolve demanding environmental issues (Sharma & Vredenburg, 1998; Buysse & Verbeke, 2003).

Community groups can mobilise public opinion in favour of or against a company's environmental approach (Roome & Wijen, 2006; Benn, Dunphy & Martin,

2009). Firms that fail to yield to this secondary stakeholder pressure therefore risk enduring public protests (Hoffman, 2000). Furthermore, community stakeholders may publicise information that could persuade customers to favour the products of competitors that have demonstrated a stronger regard for the environment. These stakeholders are therefore instrumental in providing a 'social licence' for companies to operate, and they are perceived as an influencing factor for companies to adopt CMS.

Similarly, ENGOs often demand corporate climate-change-related information on behalf of the community. Their role is critical in raising pressure for climate-change-related policy action, and for shaping community concern regarding climate change risks (Hall & Taplin, 2007). In order to uphold and advocate the community's right to know about companies' GHG emissions, most ENGOs express their concern through public statements they issue. One such statement made by a leading ENGO, Climate Action Network Australia (CANA), stated that disclosing reliable and comprehensive information on GHG emissions fulfils the expectations of the wider community (Climate Action Network Australia, 2008).

ENGOs also put substantial pressure on companies to set targets in order to combat climate change (Murray, 2004). Generally, this pressure has often resulted in specific emission targets set by companies to maintain their legitimacy with the public (Kolk & Pinkse, 2004). Emission targets are thus of great symbolic value (Meyer & Rowan, 1977), as they signify a company's sincere commitment to address climate change (Kolk & Pinkse, 2007). Target setting can even be found in countries that have not ratified the Kyoto Protocol. Furthermore, firms in environmentally-sensitive industries are generally subject to greater scrutiny from ENGOs than others, and have greater incentives to make more extensive environmental disclosures (Cowen, Ferreri & Parker, 1987; Patten, 1991; Deegan & Gordon, 1996; Cho & Patten, 2007).

Along with the initiation of national and NGO programs, increased media coverage on the science behind climate change plays an influential role in shaping community perceptions and increasing public awareness about climate change threats (Mormont & Dasnoy, 1995; Boykoff & Roberts, 2007; Antilla, 2010). Ader (1995) showed that the extent of attention by the media on pollution issues positively influences community concerns. This suggests that media attention (e.g. via press coverage) directly

underlies public pressures that managers face regarding their firm's environmental management activities (Hooghiemstra, 2000). The extent of media coverage can raise a firm's visibility in relation to GHG emissions, inviting further public attention and scrutiny (Bansal, 2005). This then results in stronger pressure on the firm to publicly account for its activities and performance, including climate change policies and impacts. Furthermore, the threat of negative media publicity can apply coercive pressure on firms to commit to sustainable development.

In the specific context of climate change and related carbon emissions, companies adopting reduction and all-rounder strategy (as discussed in Section 5.2) reflect a proactive posture to mitigate carbon emissions. As a result, they often opt for effective management of their relationships with secondary stakeholders. Thus, they respond to secondary stakeholder pressure by opening their carbon management activities to public scrutiny via environmental communications and reporting practices. Although the pattern of carbon emissions responses often differs, depending on companies' degrees of proactivity – that is, their tendency to anticipate environmental protection needs. Many introduce changes as a response to secondary stakeholders' demands rather than as a response to environmental requirements and demands.

In contrast, firms that adopt compensation strategy generally have a narrower focus on reduction of carbon emissions, as their actions are more likely to be driven by their concern over environmental regulations (see H2A). These firms do not generally implement GHG emissions reduction strategy via process improvement and product development; hence, it is often more reactive rather than proactive. Thus, firms with compensation strategy are less likely to interact with secondary stakeholders in so far as climate change related issues are concerned consequently, unless a disastrous environmental event happens. Secondary stakeholders are not likely to engage much with reactive firms particularly since they do not claim to be leaders in relation to climate change issues. Based on this discussion, hypothesis H2C related to RQ3 is formulated as follows:

*H2C: The perceived pressure from secondary stakeholders is more likely for firms adopting reduction strategy and all-rounder strategy and less likely for firms adopting compensation strategy*.

## 3.5 CMS ADOPTION: IMPACT ON FIRM PERFORMANCE

### 3.5.1 Environmental Management Practice (EMP) and firm performance

There has been a recent surge of research interest in regard to the impact of EMPs on firm performance. EMPs are the techniques, policies and procedures a firm uses that are specifically aimed at monitoring and controlling the impact of its operations on the natural environment. The scope of an EMP can be operational, tactical or strategic. According to Rondinelli and Vastag (1996), firms generally adopt EMPs either as a reaction to an increasingly challenging regulatory environment or in response to market pressure for adopting EMPs. Regardless of the motivation, the responses of firms to exogenous pressures have also rendered the emergence of EMPs that impact profitability.

Numerous firms are now exploring the benefits of adopting a proactive approach to environmental policies via EMPs; some with expectations of more efficient utilisation of resources to gain a competitive advantage and improve the corporate image (Montabon et al., 2007). Porter's (1990) 'win–win' argument was one of the first in the relevant literature to challenge the conventional understanding that government environmental standards negatively impact costs of firms. He contended that the benefits that environmental management introduce are far greater than the costs, and that tighter regulatory standards will in fact lead to innovation. As a continuation of this argument in regard to innovation potential, Porter and Van der Linde (1995) proposed the idea of 'innovation offsets'. That is, they believed that environmental regulations can actually lead to innovations, resulting in benefits that potentially offset the costs of complying with the regulations. They described two broad categories of innovations: (1) innovations that are intended to minimise the cost of pollution post-facto; and (2) innovations to improve resource productivity, to avoid pollution in the first place.

There are also other authors who have more broadly argued the benefits of proactive EMPs. For example, Berry and Rondinelli (1998) emphasised proactive EMPs and the importance of internal environmental strategies to promote improved performance. They maintained that firms that adopt environmentally proactive policies will have lower regulatory-related expenses than firms that are merely aiming for compliance. They also argued that being environmentally-proactive will lead to new business opportunities created via increasing demand for both 'clean products and processes', and via participation in voluntary internationals standards. In line with this,

Hanna and Newman (1995) earlier provided other authors' arguments favouring win–win scenarios. They found increased customer demand for environmentally-friendly products and services as a potential explanation for making a link between environmental and firm performance. Their discussion also covered the elimination of waste (i.e. emissions and refuse) as a means of lowering costs.

Florida (1996) is one of the pioneers to empirically investigate the relationship between EMPs and firm performance. Using survey methodology, he developed a link between advanced manufacturing, productivity and environmental performance. His findings suggest that efforts in improving manufacturing processes and productivity create substantial opportunity for improved environmental performance, which somewhat supports the win–win argument of Porter (1990).

In another similar study, Hart and Ahuja (1996) examined whether toxic chemical emission reduction enhances a firm's operating and financial performance in concurrent and subsequent periods. Using a sample of 127 S&P 500 firms, they found that the percentage reduction in emissions between 1988 and 1989 was associated with an improvement in three measures of financial performance – return on sales, assets, and equity – in between 1990 and 1992. The authors interpreted their findings as suggesting it does 'pay to be green', although the economic benefits of becoming green appear to occur one to two years later.

Sharma and Vredenburg (1998) in their survey of oil and gas firms in Canada found that the firm's environmental strategies, organisational capabilities and financial benefits were interrelated. In another survey of managers in the furniture industry, Klassen and Whybark (1999) reported that the firm's self-reported environmental commitment was positively correlated to the firm's environmental performance (based on toxics release data) and a number of performance indicators including product quality, on-time delivery and manufacturing cost.

Furthermore, using data from 1990 to 2003 for the four most polluting industries in the United States (pulp and paper, chemical, oil and gas, and metals and mining), Clarkson, Li and Richardson (2011b) found that firms that notably improved on environmental performance over the 14-year period had experienced significant prior

increases in return on assets (ROAs) and operating cash flows, consistent with the RBV of the firm. Examining the 'consequences change' analysis[18], the overall results indicate that even though a proactive environmental management strategy is often associated with improved future economic performance (i.e. it pays to be green), not all firms can mimic such a strategy. It would appear that only firms with sufficient resources and management capabilities can pursue a proactive environmental management strategy.

In the context of climate change, companies are not only facing the challenge of carbon emissions reduction to mitigate climate change (Okereke, 2007; Weinhofer & Hoffmann, 2010), but also how climate change will impact their operations. In line with this, GHG emissions are now widely used to measure corporate environmental performance. The next section therefore discusses prior research devoted to the identification of a relationship between GHG emissions and firm performance.

### 3.5.2 GHG emissions and firm performance

Climate change strategies can drive different economic benefits, such as improved access to capital, fulfilment of customer expectations, and access to government subsidies and certain public contracts (Deloitte & Touche, 2006; Esty, 2007; Jeswani et al., 2008). The most commonly perceived benefit is the reduction of energy costs likely to occur due to the minimised use of fossil fuels (e.g. Hoffman, 2006; Grant Thornton, 2007; Boiral et al., 2012). Such savings depend largely on the cost of fossil fuels, the energy usage of the company, and the ease of reducing consumption or of finding competitively-priced renewable energy. It has also been suggested that energy-efficiency measures are also likely to lead to technological innovations and the development of firm capabilities that enhance productivity and competitiveness (Hoffmann et al., 2009; Nitin et al., 2009; Pinkse & Kolk, 2010; Boiral et al., 2012).

Companies that do not address climate change in their corporate strategies may face negative impacts, as it may expose them to risks in terms of their competitive position (Nitin et al., 2009; Kearney, 2010; Boiral et al., 2012). For instance, a lack of substantial

[18] Compared with the more traditional 'levels' analysis, 'consequences change' analysis can identify the year and when a change in environmental strategy occurs, which increases the power of tests examining the causes and consequences of adoption or abandonment of proactive environmental strategies. Since the decision to pursue a proactive environmental strategy is not directly observable, this research infers a change in the firm's environmental strategy from pronounced changes in its relative environmental performance over time (Clarkson et al., 2011b).

corporate climate change commitment or transparent strategy may limit a firm's ability to avail the economic opportunities that these issues present, such as the sale of tradable emission permits and GHG emissions reduction technological innovations.

In contrast with the perceived benefits, Busch and Hoffmann (2011) and Delmas and Nairn-Birch (2011) reported that firms had been financially penalised for reducing GHG emissions when using accounting-based measurements such as ROA and return on equity (ROE). Using Tobin's Q both studies (Busch and Hoffmann, 2011; Delmas and Nairn-Birch, 2011) found negative impacts of increased carbon emission amounts on corporate financial performance. Using multiple regression models and data from a sample of 69 Australian public companies, Wang et al. (2013) found that a stronger Tobin's Q positively correlates with higher GHG emissions across all industry sectors. Table 3.2 shows the various measures used in the previous social and environmental accounting literature to analyse corporate financial performance.

**Table 3.2: Measures of corporate financial performance used in literature**

| Measure | Description | Relevant literature |
|---|---|---|
| Tobin's Q | The market value of equity divided by replacement cost | Wang et al. (2013)<br>Delmas and Nairn-Birch (2011)<br>Busch and Hoffmann (2011)<br>King and Lenox (2001) |
| ROA | The ratio of income to total assets | Delmas and Nairn-Birch (2011)<br>Busch and Hoffmann (2011)<br>Russo and Fouts (1997)<br>Hart and Ahuja (1996) |
| ROE | The ratio of income to firm equity | Delmas and Nairn-Birch (2011)<br>Busch and Hoffmann (2011)<br>Russo and Fouts (1997)<br>Hart and Ahuja (1996) |
| Return on investment | The ratio of operating income to book value of assets | Russo and Fouts (1997)<br>Hart and Ahuja (1996) |

The literature also suggests that more accurate results in terms of GHG emissions are obtained if specific countries and their carbon regulations are taken into account (Ziegler, Busch & Hoffmann, 2009). In a market with a clear carbon regulation in place, such as the ETS in the EU, portfolios with bought stocks including corporations with proactive responses to climate change, and sold stocks including corporations with no climate change efforts incur more losses than in the United States where there is no such national market mechanism (Ziegler et al., 2009). In another study, Chapple, Clarkson and

Gold (2013) investigated the impact of proposed ETS legislation on Australian securities market. Using a combination of the event study method and the Ohlson valuation model, along with data from a sample of 58 ASX-listed firms in 2007, they found that the market penalises firms with greater carbon intensity.

In summary, the analysis of relationships between GHG performance and firm's financial performance is polarised between two main approaches: win–lose; and win–win. The win–lose approach suggests that the efforts companies make to reduce their carbon emissions result in costs that could diminish their competitiveness (Boiral et al., 2012). In contrast, the win–win approach argues that carbon emission reduction efforts help improves corporate competitiveness (Schultz & Williamson, 2005; Boiral, 2006; Hoffman; 2006; Jones & Levy, 2007; Okereke & Russel, 2010). The latter is increasingly becoming more dominant in the social and environmental accounting literature.

Continuing the focus on GHG emissions, the next two sub-sections discuss the relationship between CMS adoption and financial performance as well as carbon performance, and the related hypotheses that are developed based on the win–win argument.

#### *3.5.2.1 The relationship between CMS adoption and firm financial performance*

Understanding the relationship between corporate social performance and financial performance has been the focus of considerable research (e.g. Margolis & Walsh, 2003; Ambec & Lanoie, 2008). In this broader context, a number of scholars have also investigated whether firms are financially rewarded for improving environmental performance (Orlitzky, Schmidt & Rynes, 2003). The conventional wisdom concerning environmental protection is that it comes at an additional cost imposed on firms, which may erode their global competitiveness. However, this paradigm has been challenged by a number of scholars (e.g. Porter & Van der Linde, 1995) who have argued that improving a company's environmental performance can instead lead to better economic performance. This is commonly perceived as the win–win argument, as introduced in Section 3.5.1. Furthermore, the RBV of the firm suggests that proactive corporate environmental strategies that go beyond regulatory compliance can have a positive effect on corporate financial performance (Hart, 1995; Russo & Fouts, 1997; Sharma &

Vredenburg, 1998; Christmann, 2000; Aragon-Correa, Hurtado-Torres, Sharma & Garcia-Morales, 2008).

As discussed in Section 2.5, RBV posits that competitive advantage for a firm lies primarily in the application of the bundle of valuable resources at the firm's disposal (Wernerfelt, 1984). That is, to transform a short-run competitive advantage, such as a cost advantage derived from adopting eco-efficient practices into a sustained competitive advantage, the resources must be valuable, non-substitutable, rare and/or specific (Barney, 1991). Such resources should be difficult for competitors to replicate because they are either tacit or socially complex (Hart, 1995).

Further grounded in the RBV of the firm, Russo and Fouts (1997) highlighted the role that environmental management plays in generating broader organisational advantages that allow firms to capture premium profits. Furthermore, they provided theoretical support for their contention that firms that tend towards a reactive environmental strategy will differ in their resource base from those that tends towards a proactive strategy, and that this strategic choice will affect a firm's ability to generate profits. Using independently-developed environmental ratings, their study found a positive relationship between a firm's environmental and financial performance, and concluded that it pays to be green.

In line with this, RBV argues that if resources are managed efficiently, it can differentiate the firm from its competitors, and can lead to a competitive advantage and potentially improve the financial performance of the firm (Zott, 2003). It has been suggested that such differentiation can take shape in various forms, including environmental differentiation (Bansal & Roth, 2000) which can yield two categories of competitive advantage: (1) cost advantage; and (2) differentiation advantage.

Cost advantage most often results from environmentally-friendly production processes such as redesigning the process to make it less polluting and using energy-efficient appliances or manufacturing processes (Dechant & Altman, 1994; Porter & Van der Linde, 1995). The primary intention of such upgrades is to reduce the production cost by increasing the energy efficiency of production processes through the reduction of input

and waste during the manufacturing process (Hart, 1995; Stead & Stead, 1996; Albertini, 2013).

Differentiation advantage is the outcome of environmental management practices that focus on product characteristics and markets. The product-focused aspects include redesigning packaging, implementing more environmentally-responsible production processes, and developing new environmentally-friendly products (Albertini, 2013). The consequent differentiation advantage creates the potential to increase product prices which would leverage higher revenues (Dechant & Altman, 1994; Hart & Ahuja, 1996; Stead & Stead, 1996; Reinhardt, 1999). Thus, corporate environmental practices based on product characteristics can lead to new ways to optimise operations (Albertini, 2013). Furthermore, such practices can reduce liability costs from potential spills or health and safety exposures that can incur high insurance premiums. In line with this, Porter and Van der Linde (1995) argued that pollution is a waste of resources and represents unnecessary costs for the firm. Accordingly, costs can be reduced by exploiting ecological efficiencies such as waste reduction, energy conservation and improved utilisation of raw materials; thereby contributing to improvements in overall economic performance (e.g. King & Lenox, 2002; Burnett & Hansen, 2008).

Within the environmental management literature, various researchers have argued that the ability to integrate the natural environment into the strategic planning process is a unique organisational capability (e.g. Russo & Fouts, 1997; Judge & Douglas, 1998; Aragon-Correa & Sharma, 2003). These studies have sought to identify the specific capabilities developed by firms adopting more proactive environmental strategies, and their contribution to sustained competitive advantage. For example, Ambec and Lanoie (2008) pointed out that carbon management can provide a number of potential opportunities to increase revenue, such as better access to certain markets, and enhanced ability to offer differentiated products and to sell pollution-control technology. In addition, they also highlighted possible opportunities to reduce costs including cost of material, energy and services, cost of capital, cost of labour, and enhanced risk management and relationships with external stakeholders.

Based on above discussion, CMS adoption can be considered a strategic resource that creates value for the firm by differentiating its activities from its competitors. Thus,

firms are able to improve their products and internal processes and reduce their operation costs via carbon emissions management. Hence, CMS adoption enables firms to develop their organisational capabilities. Furthermore, firms can also increase their total revenues because they are able to differentiate themselves from their competitors and gain external reputation and legitimacy. Thus, the following hypothesis related to RQ4 is developed:

*H3A: Firms that adopt CMS are more likely to have better financial performance compared with firms that do not adopt CMS.*

#### *3.5.2.2 The relationship between CMS adoption and firm carbon performance*

The execution of corporate responsibilities towards society and environment is most often determined by management's overall strategy (Ullmann, 1985). As societal expectations regarding firms' environmental responsibilities increase, environmental performance is becoming an area where strategic opportunities can be identified (Hart, 1995). Environmental performance is the result of an organisation's management of its environmental impacts, which means that at the conceptual level, the benefits of environmental management are often diverse. Such benefits can include lower liabilities and costs of regulatory compliance due to a reduction in the risk of environmental accidents (e.g. Sharma & Vredenburg, 1998; Epstein & Wisner, 2005). Furthermore, a range of internal and external competitive organisational benefits include increased capacity for product and process innovations, and organisation-wide learning and knowledge among employees (e.g. Hart, 1995; Russo & Fouts, 1997; Sharma & Vredenburg, 1998; Aragon-Correa & Sharma, 2003).

As part of the benefits derived from environmental management, carbon performance also enables stakeholders to accurately assess a company's stake in climate change and its efforts to better manage carbon emissions (Hoffmann & Busch, 2008). For example, to reduce their carbon intensity (i.e. the amount of carbon burned as fossil fuel per unit of energy), high carbon emitters are required to switch to less carbon-intensive technologies and processes. However, the costs of complying with increasing regulations related to carbon emissions are expected to be economically significant, and experts agree that the firm's carbon intensity will dictate which firms will face the greatest costs of regulatory compliance (e.g. PricewaterhouseCoopers, 2009). The primary goal of requiring firms to measure, monitor, disclose and pay for their carbon emissions is to

ultimately reduce the overall level of emissions in the environment (Fornaro, Winkelman & Glodstein, 2009).

When examining the capabilities required reducing GHG emissions related to processes and products, firms must first understand how their operations impact on environment. By assessing their energy use and related GHG emissions, firms can more readily identify operational inefficiencies and existing processes that require modification. Such assessments also generally help companies identify opportunities to optimise materials usage (Frosch & Gallopoulos, 1989). In addition, these process-related GHG reductions often require firms to develop a well-rounded continuous improvement approach, facilitating organisation-wide changes that encourage the firm to consistently improve its internal operations around a common goal (Falk, 2002). Extensive knowledge and monitoring of a firm's resources, constraints, production capabilities and processes, in addition to long-term strategic planning are also required to reduce GHG emissions (Darnall & Edwards, 2006).

Despite the former long-term perspective, the literature on environmental management generally depicts a positive relationship between proactive firm efforts to reduce negative environmental impacts and firm-level financial performance (e.g. Hart & Ahuja, 1996; Russo & Fouts, 1997). Several studies have shown that in promoting environmental proactivity, managers are striving to positively affect their firm's financial performance according to different but complementary measures of corporate wealth (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013). These enable firms to adopt an effective environmental leadership strategy within their internal networks.

Furthermore, pollution prevention allows firms to eliminate environmentally-hazardous production processes, redesign existing product systems to reduce lifecycle impacts, and develop new products with lower lifecycle costs (Hart, 1995). Consequently, more advanced environmental strategies can emerge to assist organisations in achieving greater organisational efficiency (e.g. Hart & Ahuja, 1996; Christmann, 2000; Nakamura, 2011). Firms can also gain a competitive advantage in different areas of product development in terms of miniaturisation, weight reduction, and design for reuse and reparability (Henriques & Sadorsky, 1996; Christmann, 2004; Darnall, 2006). Despite such

cumulative benefits, the ultimate result of these efforts is to reduce pollution (Christmann, 2000; Sharma, 2000).

Based on the above, it is conceivable that firms which adopt CMS have a stronger inclination to achieve better carbon performance and thereby enabling them to remain a step ahead of competitors. Hence, the following hypothesis related to RQ4 is proposed:

*H3B: Firms that adopt CMS are more likely to have better carbon performance compared with firms that do not adopt CMS.*

## 3.6 CHAPTER SUMMARY

This chapter has examined the existing relevant literature on climate change, CMS adoption, stakeholder pressure as well as firm performance, which has been used to formulate hypotheses relating to the four RQs as presented in Section 1.3 of Chapter 1. A summary of these RQs along with their respective hypotheses is provided in Table 3.3. The subsequent Chapter 4 discusses the sample, dataset, empirical models and estimation techniques to test the hypotheses developed in this chapter.

**Table 3.3: Summary of RQs and hypotheses**

| |
|---|
| **RQ1:** What are the various types of CMS adopted by ASX 200 publicly-listed companies? |
| **RQ2**: Do internal organisational factors drive companies to adopt CMS in order to maintain legitimacy? |
| **H1A**: Firms that have voluntarily established an EMS are more likely to adopt CMS than those firms without an EMS.<br><br>**H1B**: Firms with an environmental committee are more likely to adopt CMS than those firms without such a committee.<br><br>**H1C**: The higher the number of board members, the greater the likelihood of the firm adopting CMS.<br><br>**H1D**: The higher the number of independent board members, the greater the likelihood of the firm adopting CMS. |
| **RQ3**: Do companies' likelihood of adopting a given CMS depend on the pressure from certain groups of stakeholder? |
| **H2A**: The perceived pressure from regulatory stakeholder is more likely for firms adopting compensation strategy and less likely for firms adopting reduction strategy as well as all-rounder strategy.<br><br>**H2B**: The perceived pressure from primary stakeholders is more likely for firms adopting reduction strategy and all-rounder strategy and less likely for firms adopting compensation strategy.<br><br>**H2C**: The perceived pressure from secondary stakeholders is more likely for firms adopting reduction strategy and all-rounder strategy and less likely for firms adopting compensation strategy. |
| **RQ4**: Do companies' CMS adoption relate to their financial as well as carbon performance? |
| **H3A**: Firms that adopt CMS are more likely to have better financial performance compared with firms that do not adopt CMS.<br><br>**H3B**: Firms that adopt CMS are more likely to have better carbon performance compared with firms that do not adopt CMS. |

# CHAPTER 4

# RESEARCH DESIGN

## 4.1 INTRODUCTION

In this chapter, a detailed discussion and justification of the research approach taken in this study is presented. This chapter is structured as follows. Section 4.2 discusses the data and sample. Section 4.3 describes the content analysis method and the procedures used in this study including the criteria developed to identify CMS adoption. Empirical models used to test the hypotheses are then explained in Section 4.4. The chapter is then summarised in Section 4.5.

## 4.2 DATA AND SAMPLE

### 4.2.1 Sample

The sample consists of the S&P/ASX[19] top 200 publicly-listed firms, which has been selected because it comprises some of the top GHG emitters in the world such as Rio Tinto and BHP Billiton. As such, it constitutes a significant group involved in climate change governance both in terms of quantity of GHG emissions as well as influence on national climate policy (Carbon Disclosure Project Australia and New Zealand Report, 2012).

This study examines annual panel data from S&P/ASX over a five-year period from 2008 to 2012. It commences in 2008 because this was the first year in which ASX 200 firms were included in the CDP information request. It is also worth noting that CDP survey respondents have demonstrated an increasing desire to act on climate change, and have been steadily developing their approach to climate change management (CDP Australia and New Zealand Report, 2012). The five years covered in this study relate to a period of mandatory disclosure of GHG emissions in Australia. The corresponding

[19] ASX 200 represents around 78% of the Australian share market (Standard & Poors, 2013), and comprises a diverse number of Global Industry Classification Standard (GICS) sectors like materials, energy, industrials, consumer staples, telecommunication services, financials etc.

*NGER Act 2007* which mandates GHG emissions reporting became effective from 1 July 2008.

The final year of the sample period is 2012 as it marks the last reporting period before Australian firms were subjected to regulatory cost sanctions in the form of carbon tax as mandated in the *Clean Energy Act 2011*. In essence, this five-year period was chosen as it is envisaged that during this transition period, corporate decisions to implement CMSs were not driven by carbon pricing mechanism. It is instead assumed that during this period CMS adoption was motivated by legitimacy pressure resulting from mandatory emissions reporting and increasing stakeholders concern about climate change.

The sample selection procedure for each RQ is described in Panel A of Table 4.1. The expected number of observations over the five-year period was 1,000 firm-years (i.e. 200 firms x 5 years = 1,000). Panel A also shows that a total of 106 firm-year observations was excluded from RQ2 sample due to insufficient data; thereby bringing the total sample for that question to 894. For RQ3 sample, 150 firm-year observations were excluded due to missing stakeholder or financial information, or both. Thus, the sample for RQ3 was 850 (200 firms x five years = 1,000 firm-years; 1,000 – 150 = 850) firm-year observations over the five-year period. For RQ4 sample, the study excluded 81 firms due to missing financial information. This final sample for RQ4 therefore comprised the remaining (1,000 firm-years; 1,000 – 81 = 919) firms, with a total of 919 firm-year observations over the five-year period.

Panel B of the same table shows the sample firms according to 10 Global Industry Classification Standard (GICS) sectors: consumer discretionary; consumer staples; energy; financials; health care; industrials; information technology; materials; telecommunication services; and utilities. Panel C of the table next lists the sample breakdown of observations across the five-year period.

**Table 4.1: Sample description**

| **Panel A: Sample selection** | **RQ1** | **RQ2** | **RQ3** | **RQ4** |
|---|---|---|---|---|
| Number of firms | 1,000 | 1,000 | 1,000 | 1,000 |
| Less: | | | | |
| Firms without sufficient information | - | 106 | 150 | 81 |
| Total firm-years | 1,000 | 894 | 850 | 919 |
| **Panel B: Sample by GICS sector** | | | | |
| Consumer discretionary | 118 | 105 | 101 | 109 |
| Consumer staples | 49 | 42 | 38 | 41 |
| Energy | 111 | 99 | 95 | 103 |
| Financials | 168 | 154 | 148 | 160 |
| Health care | 56 | 48 | 44 | 48 |
| Industrials | 162 | 147 | 142 | 154 |
| Information technology | 19 | 17 | 13 | 14 |
| Materials | 239 | 216 | 211 | 228 |
| Telecommunication services | 17 | 15 | 11 | 12 |
| Utilities | 61 | 51 | 47 | 50 |
| Total firm-years | 1,000 | 894 | 850 | 919 |
| **Panel C: Sample by year** | | | | |
| 2008 | 200 | 174 | 166 | 179 |
| 2009 | 200 | 177 | 169 | 182 |
| 2010 | 200 | 178 | 170 | 183 |
| 2011 | 200 | 181 | 173 | 186 |
| 2012 | 200 | 184 | 172 | 189 |
| Total firm-years | 1,000 | 894 | 850 | 919 |

### 4.2.2 Sources of data

Social and environmental accounting researchers considered the annual report as the main source of information about a company (e.g. Neimark, 1992; Gray, Kouhy & Lavers, 1995; Adams, Hill & Roberts, 1998; Deegan et al., 2002). However, as most firms have a range of stakeholders that require such information, it is unlikely that the annual report will meet the needs of all of them, particularly in relation to corporate social responsibility (e.g. Lindblom, 1994; Neu et al., 1998; Deegan & Blomquist, 2006; Simnett, Vanstraelen & Chua, 2009c). Standalone social and environmental reports are now more often published to disclose sustainability information (Frost, Jones, Loftus & Laan, 2005; Jones & Levy, 2007; Simnett et al., 2009c). Consequently, as internet usage gains momentum, most firms maintain a website that various stakeholders (e.g. community groups, government agencies, journalists and members of the general public) turn to for

additional information (Clarkson, Li, Richardson & Vasvari, 2008). Thus, firms' annual reports and sustainability reports are also typically available on their websites.

In view of the various ways of reporting a firm's sustainability and social responsibility measures, this study has used multiple secondary data sources including CDP survey responses and other publicly-available information such as company websites, annual reports and standalone sustainability reports. CDP is a non-profit organisation claiming to hold the largest database of primary corporate climate change information in the world[20] (Carbon Disclosure Project, 2012). Voluntary participation in the annual CDP survey provides companies with an opportunity to identify strategies that can help them mitigate GHG emissions (Andrew & Cortese, 2011). The CDP questionnaire asks for information on carbon emissions accounting, carbon emissions intensity, climate change risk and opportunity, and carbon emissions trading. CDP claims that the reporters benefit by providing a means through which companies can analyse GHG emissions and internal energy policies (Carbon Disclosure Project, 2012). In this regard, CDP was considered the most appropriate data source for this study to investigate various CMSs adopted by the ASX 200.

Furthermore, corporate reports are the documents by which companies publicly disclose their past performance, future expectations and any other information that the managers deem necessary to communicate to their stakeholders (Staw, McKechnie & Puffer, 1983). As such, it was considered important in this study to supplement CDP data with other publicly-available corporate reports (such as annual reports and sustainability reports), particularly for companies which do not participate in the CDP survey. Table 4.2 presents the secondary data sources.

[20] CDP requests information from the world's largest companies as measured by market capitalisation. Currently, CDP acts on behalf of 722 institutional investors representing more than $87 trillion of funds under management (CDP Australia and New Zealand Climate Change Report, 2013). The overall response rate for ASX 200 companies is 50% (CDP Australia and New Zealand Climate Change Report, 2012, p. 22).

**Table 4.2: Sources of secondary data**

| Year | CDP survey | Annual report and/or sustainability report | Total |
|---|---|---|---|
| 2008 | 57 | 143 | 200 |
| 2009 | 69 | 131 | 200 |
| 2010 | 73 | 127 | 200 |
| 2011 | 69 | 131 | 200 |
| 2012 | 77 | 123 | 200 |
| Total | 345 | 655 | 1000 |

EMS, environmental committee and board composition data were mainly hand-collected from Directors' report section of the annual report. Stakeholder such as regulator, employee and investor data were collected from annual reports retrieved from DatAnalysis[21] database. The financial variables were collected from the same database. In addition, carbon emissions data were obtained from the Clean Energy Regulator website; while the media articles were extracted from Factiva[22] database. The search used keywords that included the company name and environmental issues (climate change, environmental, carbon emissions, and carbon footprint) for articles in the year of the panel. All relevant articles were included in media. Among the relevant articles, those that had a negative orientation were identified and used as a proxy of ENGO.

## 4.3 MEASURING CMS ADOPTION

### 4.3.1 Content analysis used in prior research

Content analysis has been defined as "a research technique for making replicable and valid inferences from data to their context" (Krippendorff, 2004, p. 21). It is different from other textual analysis techniques in this it allows the text to be condensed into a quantitative format (Ingram & Frazier, 1980).

Prior social and environmental accounting research has employed a variety of approaches to content analysis; some have used content analysis techniques based on indexing and weighting scales (e.g. Freedman & Jaggi, 1982; Wiseman, 1982; Freedman & Wasley, 1990; Patten, 2002; De Villiers & Van Staden, 2006), or unitising procedures

[21] DatAnalysis is Australia's longstanding premium research tool for information on companies listed on the ASX – it has information on all companies currently listed on ASX as well as delisted companies since 1989.

[22] Factiva is a business information and research tool owned by Dow Jones and Company, which aggregates content from both licensed and free sources, and provides organisations with search, alerting, dissemination and other information management capabilities. Factiva products provide access to more than 32,000 sources (e.g. newspapers, journals, magazines, television and radio transcripts, and photos) from nearly every country worldwide in 28 languages.

(e.g. Cowen et al., 1987; Gray et al., 1995; Hackston & Milne, 1996; De Villiers & Lubbe, 2001; Haque & Deegan, 2010; De Villiers & Van Staden, 2011b; Hrasky, 2012). Units employed in content analysis techniques in prior studies include number of words, number of sentences, number of pages, percentage of pages, and percentage of total disclosure (Deegan & Gordon, 1996; Deegan & Rankin, 1996). In the specific context of climate change and related carbon emissions, there are a number of studies that have used content analysis (e.g. Kolk & Pinkse, 2005; Weinhofer & Hoffmann, 2010; Lee, 2012).

For example, Weinhofer and Hoffmann (2010) defined a guiding question for each type of carbon strategy using content analysis. They constructed categories as a group of words with similar meaning or connotations, and then developed a measurement scale in which the 'measure score' characterises the earliest point in time when a company takes the measure. A codebook was also developed in which all categories and their measurements were fully explained to make the coding set complete and unambiguous. Similarly, Lee (2012) developed a coding rule for content analysis by considering the six carbon management activities. Each of the six carbon activities was measured on a fully fixed 5-point Likert scale which reflected the levels of proactivity, with 5 representing a 'high level of involvement and/or implementation' and 1 representing a 'low level of involvement and/or implementation'.

Furthermore, using content analysis, Kolk and Pinkse (2005) developed a measurement instrument to explore the market strategies towards climate change. This climate change strategy matrix enabled the multidimensional measurement of each construct, where companies were rated based on the conceptual definition of each of the six cells of the matrix. Thus, climate strategy was measured on a fully anchored 5-point scale, with different anchors per six dimensions. For each of the six dimensions, the anchors were rated on an increasing scale corresponding with the level of proactivity of the climate strategy option.

Using secondary data sources (e.g. annual reports, environmental reports and company websites), Sharma and Henriques (2005) and Montabon et al. (2007) conducted a content analysis to collect data on environmentally-sustainable practices among firms. To further identify environmental initiatives and performance across firms, Jacobs, Singhal and Subramanian (2010) conducted a content analysis of daily newspapers. In

addition, by using industry journals, Hoffman (2001) and Lee and Rhee (2005) both collected data on corporate environmentalism.

Prior research has used content analysis to analyse the corresponding reporting in various firm publications, especially annual reports (e.g. De Villiers & Barnard, 2000; De Villiers & Lubbe, 2001; Antonites & De Villiers, 2003; Haniffa & Cooke, 2005; De Villiers & Van Staden, 2006; Branco & Rodrigues, 2008; Clarkson et al., 2008; Haque & Deegan, 2010; Cowan & Deegan, 2011; Clarkson et al., 2011a; De Villiers & Van Staden, 2011b; Elijido-Ten & Clarkson, 2015). Several indices such as the Domini 400 Social Index, the FTSE4Good Index Series[23], and the Dow Jones Sustainability Index have been adopted (e.g. Aslaksen & Synnestvedt, 2003; Cowton, 2004; Schroder, 2007; Collison, Cobb, Power & Stevenson, 2008) to measure firms' social and environmental performance.

### 4.3.2 Content analysis used in this study

Consistent with previous research, content analysis is used in this study to analyse and identify the different types of CMS adoption among the sample of Australian firms. There are numerous advantages from choosing to use content analysis in this study. First, content analysis is a non-reactive technique. A vital aspect of non-reactive research is that the person, group or organisation being studied is not aware of that fact (Neuman, 2000). Furthermore, interviewer and social desirability bias which may occur when using questionnaires or conducting interviews is generally avoided via non-reactive research (Neuman, 2000). Second, the data can be provided in various forms, which is highly suitable when such information already exist in a variety of formats (Krippendorff, 2004). For example, companies can disclose environmental information via various mediums including annual reports, sustainability reports, websites, press releases, verbal statements and advertisements. Third, content analysis permits the researcher to explore not only the number of times a particular phenomenon occurs, but also an exploration of the underlying meaning of the material being scrutinised (Krippendorff, 2004). Fourth, content analysis can be used to varying degrees, from simply counting the occurrence of a particular word or phrase to pursuing fundamental themes and meanings within

[23] The FTSE4Good Index Series was designed to measure the performance of companies demonstrating strong environmental, social and governance practices. It is used in four main ways: financial products; research; reference; and benchmarking.

statements. In addition, researchers can use content analysis for large quantities of data across a variety of modes.

There are several issues that first needed to be addressed when conducting content analysis: (1) choosing the appropriate corporate reports to analyse; (2) constructing the coding categories to classify CMSs and developing coding criteria to classify companies based on their CMSs; and (3) selecting the units of analysis. The researcher should select a recording and/or measurement unit consistent with the underlying objectives of the content analysis. For example, words can be the most reliable unit of measurement for a researcher seeking the frequency with which a company uses the word 'environment' in an annual report (Neuman, 2000; Milne & Adler, 1999); however, if the researcher is using a content analysis technique to determine the underlying themes or direction of disclosures, attention must be paid to the meaning of the disclosures.

In Phase 1 of this study, the content analysis took the basic form of manually scanning selected texts to analyse and identify the different types of CMS adopted by the Australian firms in the sample. First, the content of each firm's response to the following questions in the CDP survey for each of the sample years was analysed:

- Is climate change integrated into your business strategy?
- Does the use of your goods and/or services directly enable GHG emissions to be avoided by a third party?
- Did you have emissions reduction initiatives that were active within the reporting year?
- Are carbon dioxide emissions from the combustion of biologically sequestered carbon (i.e. carbon dioxide emissions from burning biomass/biofuels) relevant to your company?
- Do you participate in any emissions trading schemes?
- Has your company originated any project-based carbon credits or purchased any within the reporting period?

While these questions simply required a 'yes' or 'no' answer, those firms that answered in the affirmative were also asked to provide further information including the nature of their climate change integration process and outcomes, the engagement process with policymakers, the number and details of relevant projects under development, and any purchased allowance/carbon credits and other related information.

Second, annual reports, sustainability reports and firm websites were scrutinised among the sample of Australian firms to supplement these CDP survey responses. In the process of content analysing these documents, CMS data were hand-collected from the sustainability section of annual reports, the environment section of sustainability reports, any environmental or sustainability website content. Finally, a systematic process of coding to analyse themes (Hsieh & Shannon, 2005; Zhang & Wildemuth, 2009) was considered more appropriate than the mere counting of words. In keeping with the literature reviewed on climate change and carbon strategy (as listed below), the following coding criteria were used to identify sample firms that adopt CMS:

- Emission trading scheme (ETS) participation: Acquiring additional carbon emissions capacity by voluntarily participating in ETSs (Jeswani et al., 2008; Weinhofer & Hoffmann, 2010).

- Carbon offset initiative: Investing in carbon emissions offsetting projects (Okereke, 2007; Weinhofer & Hoffmann, 2010; Lee, 2012).

- Product innovation: Designing new products that emit less carbon, or improving existing products to be carbon-free during their production (Kolk & Pinkse, 2005; Boiral, 2006; Okereke, 2007; Weinhofer & Hoffmann, 2010; Lee, 2012).

- Innovative technology: Changing process technology to improve the GHG inventory (Okereke, 2007; Jeswani et al., 2008).

- Process innovation: Developing new production processes that emit less carbon, or changing existing processes to be carbon-free (Weinhofer & Hoffmann, 2010; Lee, 2012), or improving process through supply chain measures (Kolk & Pinkse, 2005).

- Energy-efficiency initiative: Promoting energy-efficiency projects, such as substituting existing energy sources with cleaner fuels and reducing direct GHG emissions (Lee, 2012).

Prior to the finalisation of the above criteria, a pilot study was conducted to ensure that the initial coding criteria developed for this study were sufficient to distinguish sample firms that had adopted CMS from those that had not. This aligned with Holsti's (1969) recommendation of the testing of operational definitions and coding rules on a small sample of data before actual coding commences in a bid to enhance validity and reliability. Subsequently, the problems encountered in this study's pilot study – albeit minor – and the coding criteria were further refined, and the final coding criteria used are as listed above. Since determining whether a sample firm had adopted CMS based on the criteria was relatively uncomplicated, it was deemed here that the use of multiple coders was not necessary. This aligned with Milne and Adler's (1999) argument that when coding criteria are reliable, there is less of a need for multiple coders.

Drawing from previous studies (Kolk & Pinkse, 2005; Jeswani et al., 2008; Weinhofer & Hoffmann, 2010; Lee, 2012), this study sought to identify three types of CMS adoption: (1) compensation strategy; (2) reduction strategy; and (3) all-rounder strategy. Table 4.3 presents the criteria for each of these CMS adoption types. As the table shows, if a company takes action to meet emissions limits by purchasing emissions allowances or participating in any regional or international ETS, then it is considered as adopting compensation strategy. In contrast, reduction strategy describes the actions taken by a firm to design new products or production processes, and improve existing products and/or production processes with a view to mitigate their carbon emissions. In cases where a company adopts both or any criteria of compensation and reduction strategies, it is considered as adopting all-rounder strategy.

**Table 4.3: Criteria for different types of CMS adoption**

| Types of CMS adoption | Criteria |
|---|---|
| Compensation strategy | Increasing emissions limits by purchasing emissions allowances ***and/or*** participating in any regional or international ETS. |
| Reduction strategy | Designing greener and more energy-efficient products that emit less carbon ***and/or*** improving existing products to be carbon-free during their production or use ***and/or*** developing new production processes that emit less carbon ***and/or*** improving existing processes or changing production process by substituting input factor or raw material ***and/or*** developing energy-efficient projects, such as substituting existing energy sources with cleaner fuels and reducing the direct GHG emissions ***and/or*** reducing carbon footprint through cooperation with supply chain. |
| All-rounder strategy | Adopting one or more criteria of compensation and reduction strategies. |

## 4.4 MODELS SPECIFICATIONS FOR PHASE 2

### 4.4.1 Model for testing hypotheses 1A, 1B, 1C and 1D

The following binary logistic regression equation is used to test the hypotheses relating to internal organisational factors as possible internal drivers of CMS adoption (H1A to H1D):

$$CMS_{it} = \beta_0 + \beta_1 EMS_{it} + \beta_2 ECOM_{it} + \beta_3 BSIZE_{it} + \beta_4 BRDIND_{it} + \beta_5 FAGE_{it} + \beta_6 FSIZE_{i(t-1)} + \beta_7 LEV_{i(t-1)} + \beta_8 INDY_i + \beta_{9to12} YEAR\ DUMMIES_i + \varepsilon_{it}$$

……..Equation (1)

The subscripts i and t represent firm and year, respectively. The binary logistic regression technique is used as the dependent variable (i.e. CMS) is a dichotomous variable. The definitions including the expected sign for each variable in Equation (1) are presented in Table 4.4.

**Table 4.4: Definitions and measurements of variables for Equation (1)**

| Variables | Definitions | Hypotheses | Expected sign |
|---|---|---|---|
| CMS | Carbon management strategy (CMS) is a dichotomous variable that equals 1 if a firm adopts CMS, and otherwise 0. | | |
| EMS | Environmental management system (EMS) is a dichotomous variable that equals 1 if a firm implements an EMS, and otherwise 0. | H1A | + |
| ECOM | Environmental committee is a dichotomous variable that equals 1 if a firm has an environmental committee, and otherwise 0. | H1B | + |
| BSIZE | Board size is the number of directors on the board. | H1C | + |
| BIND | Board independence is the number of independent directors scaled by the size of the board. | H1D | + |
| FAGE | Firm age is the number of year since the firm's inception. | | + |
| FSIZE | Firm size is the natural logarithm of the firm's revenue. | | + |
| LEV | Leverage is the ratio of total debt to total assets at the end of the fiscal year. | | + |
| INDY | Industry is a dichotomous variable that equals 1 if the firm belongs to an environmentally-sensitive industry, and otherwise 0. | | + |
| Year dummies | Four-year dummy variables that equal 1 if a company is selected for the year 2008, and otherwise 0; equal 1 if a company is selected for the year 2009, and otherwise 0; equal 1 if a company is selected for the year 2010, and otherwise 0; and equal 1 if a company is selected for the year 2011, and otherwise 0. | | |

*CMS* - The key variable CMS is a dichotomous variable coded '1' if the firm adopts one or more of the CMS criteria as shown in Table 4.2, and coded '0' if none of the criteria is present.

*Environment management system (EMS)* – Companies dealing with climate change need to introduce and develop their EMS for efficient management of GHG emissions (Thornton & Hsu, 2001). EMS is a binary variable that equals 1 if a company implements an EMS, and otherwise 0 (Sumiani, Haslinda & Lehman 2007; Rankin et al., 2011).

*Environmental committee (ECOM)* – An environmental committee demonstrates the proactive corporate governance which basically guides the organisational long-term strategy towards a low-carbon future (Rankin et al., 2011). ECOM is a binary variable that equals 1 if a company states in the annual report that it has an environmental committee and otherwise 0 (Rankin et al., 2011; Liao et al., 2015).

*Board size (BSIZE)* – Evidence shows that firms that require more advice derive greater value from larger boards (Coles, Daniel, & Naveen, 2006). Larger boards are likely to include more experienced and knowledgeable directors who possess better expertise to manage environmental issues (De Villiers et al., 2011a). BSIZE is therefore measured here as the number of directors on the board (Galbreath, 2010; De Villiers et al., 2011a; Chapple & Truong, 2015).

*Board independence (BIND)* – It is calculated as the number of independent directors scaled by the size of the board (Galbreath, 2010; Khan, Muttakin & Siddiqui, 2013). A greater proportion of independent directors on the board is envisaged to result in better performance based on improved monitoring (Anderson & Reeb, 2003). Independent directors are those who meet the criteria for independence as set out in the Investment and Financial Services Association's definition that was subsequently adopted by the Australian Stock Exchange Corporate Governance Council's (2003) *Principles of good corporate governance and best practice recommendations*. According to these principles, an independent director is a non-executive director that: (i) is not a substantial shareholder of a company; (ii) has not been employed by the company within the last three years; (iii) has not been a principal of a material professional adviser to the company within the past three years; (iv) is not a material supplier or customer of the company; (v) has no material contractual relationship with the company; (vi) has not served on the board, which could materially interfere with the director's ability to act in the best interests of the company; and (vii) is free from any business relationship which could materially interfere with the director's ability to act in the best interests of the company (Australian Stock Exchange Corporate Governance Council, 2003).

As shown in Equation (1), this study also controls for several firm characteristics including:

*Firm age (FAGE)* – Older firms are more likely to possess the necessary infrastructure to manage environmental issues at a lower cost (Mohan-Neill, 1995). However, these older operations often use mature environmental technologies and capital equipment (Portney & Stavins, 2000) which may affect a firm's decision to adopt proactive environmental practices. As such, this study controls for firm's age. In addition, more mature firms are generally more concerned about their reputation and hence are

more likely to adopt CMS. FAGE is therefore measured here as the number of years since the firm's incorporation (Elijido-Ten, 2013).

*Firm size (FSIZE)* – Larger firms are more likely to identify environmental issues as a separate management priority and manage them more effectively (Al-Tuwaijri et al., 2004; Clarkson et al., 2008). They generally attract various stakeholders who force them to take on social and environmental activities as a way of retaining corporate legitimacy within their operating environment (Stanny & Ely, 2008; Tauringana & Chithambo, 2015). Larger firms are also more often linked to environmental proactivity than smaller firms (Etzion, 2007). They also often have better societal visibility (Jiang & Bansal, 2003; Etzion, 2007) which may strengthen stakeholder requests to adopt more proactive environmental strategies. In view of this, large firms are more likely to adopt CMS to mitigate carbon emissions. This study therefore controls for firm size by using the natural log of the firm's revenue (Elijido-Ten, 2013, 2017; Tauringana & Chithambo, 2015). The one-year lagged value of revenue that was used is consistent with prior relevant literature (Cornetta, Marcusb & Tehranian, 2008).

*Leverage (LEV)* – Leverage has been included as a control variable as there have been suggestions that the demand for monitoring information increases with leverage in general. For example, Clarkson et al. (2008) documented a positive association between debt levels and environmental disclosures, suggesting better environmental performance in firms with higher leverage. This study has therefore employed total debt divided by total assets as the measure of leverage (De Villiers et al., 2011a). LEV has been measured one year prior to the time window for which CMS adoption was determined, to control for potential confounding effects or simultaneity bias (Bowen, Rajgopal & Venkatachalam, 2008).

*Industry (INDY)* – There are some industries more likely to be scrutinised by multiple stakeholders, particularly those where business operations emit higher levels of harmful GHGs (PricewaterhouseCoopers, 2009). For example, the mitigation of carbon emissions is more relevant in the energy industry and other sectors that rely on fossil fuels, such as coal, oil, automobiles, power generation, and airlines (Kolk et al., 2008; Rankin et al., 2011). As a result, they also often face greater business risks. Consistent with prior literature (Wiseman, 1982; Elijido-Ten, 2013), this study considers energy, utilities,

transportation, pharmaceuticals, materials (including mining) and telecommunication industries as environmentally-sensitive industries. Thus, INDY is a dichotomous variable where a score of 1 is awarded to firms belonging to environmentally-sensitive industry, and 0 otherwise (Elijido-Ten, 2011a).

*Year dummies* – Four-year dummy variables are used in the above model: a dummy variable equals 1 if a company is selected for the year 2008, and otherwise 0; equals 1 if a company is selected for the year 2009, and otherwise 0; equals 1 if a company is selected for the year 2010, and otherwise 0; and equals 1 if a company is selected for the year 2011, and otherwise 0.

### 4.4.2 Model for testing hypotheses 2A, 2B and 2C

The following ordered probit regression equation is used to test hypotheses about the relationships between various types of CMS adoption and stakeholder pressure (H2A to H2C):

$$CMS_{it} = \beta_0 + \beta_1 REG_{it} + \beta_2 EMP_{it} + \beta_3 INS_{it} + \beta_4 MDA_{it} + \beta_5 ENGO_{it} + \beta_6 FSIZE_{i(t-1)} + \beta_7 LEV_{i(t-1)} + \beta_8 INDY_i + \beta_{9to12} YEAR\ DUMMIES_i + \varepsilon_{it}$$

……..Equation (2)

Consistent with Equation (1) the subscripts i and t in Equation (2) above represent firm and year, respectively. The ordered probit regression technique is used because the dependent variable (i.e. CMS) is an ordered categorical variable. The definitions for each variable in Equation (2) are presented in Table 4.5.

**Table 4.5: Definitions and measurements of variables for Equation (2)**

| Variables | Definitions | Hypotheses |
|---|---|---|
| CMST | Carbon management strategy type (CMST) is an ordered categorical variable that equals 0 if a company does not adopt any carbon management strategy, 1 if a company adopts compensation strategy, 2 if a company adopts reduction strategy, and 3 if a company adopts all-rounder strategy. | |
| REG | Regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0. | H2A |
| EMP | Employee is the natural logarithm of the number of employees in a company. | H2B |
| INS | Institutional investor is the percentage of shares owned by the institutional investor in a particular company. | H2B |
| MDA | Media is the total number of articles that include a statement about the company and their environmental issues. | H2C |
| ENGO | Environmental non-government organisation (ENGO) is a binary variable that equals 1 if any article portrays the company's environmental practices in a negative light, and otherwise 0. | H2C |
| FSIZE | Firm size is the natural logarithm of the firm's total assets. | |
| LEV | Leverage is the ratio of total debt to total assets at the end of the fiscal year. | |
| INDY | Industry is a dichotomous variable where 1 is awarded to firms belonging to an environmentally-sensitive industry, and otherwise 0. | |
| Year dummies | Four-year dummy variables that equal 1 if a company is selected for the year 2008, and otherwise 0; equal 1 if a company is selected for the year 2009, and otherwise 0; equal 1 if a company is selected for the year 2010, and otherwise 0; and equal 1 if a company is selected for the year 2011, and otherwise 0. | |

*CMST* - The key variable CMST is derived from content analysis discussed in Section 4.3.2. It is an ordered categorical variable (0,1,2,3) that equals 0 if a company does not adopt any CMS, equals 1 if a company adopts a compensation strategy, equals 2 if a company adopts a reduction strategy, and equals 3 if a company adopts an all-rounder strategy.

*Regulation (REG)* – Government intervention is one of the driving forces stimulating corporate disclosure of carbon emissions (Lees, 2010). The purpose is to incorporate a national commitment to the mitigation of carbon emissions. It involves the reporting of carbon emissions information, mainly quantified in corporate annual reports and verified by auditors, and assists in the measurement of contributions made by firms to reduce emissions. Thus, disclosure of carbon emissions information facilitates regulatory bodies to monitor the responsibilities of firms including evaluating their environmental strategies (Yapa, Harvey & Ellis, 2005). Prior studies have suggested that due to increasing regulatory pressures, firms are now disclosing detailed carbon emissions information (e.g. Crawford & Williams, 2010). Researchers have also indicated that

carbon accounting and disclosure will continue to move from voluntary reporting to legislative compliance, and that governments are now more likely to regulate the relevant reporting standards (e.g. Keyes & Schilmoeller, 2009; Simnett, Green & Huggins, 2009a; Lees, 2010). In Australia, the *NGER Act 2007* provides a single nation regulatory framework for the reporting of GHG emissions by organisations which meet a particular threshold[24]. As part of this Australian legislation, there are penalties and executive liabilities for non-compliance. This study has therefore used the *NGER Act 2007* as a proxy for regulatory stakeholders. The corresponding REG is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0 (Li et al., 2014).

*Employee (EMP)* – Due to increasing environmental awareness globally, employees are also beginning to pay more attention to their employer company's environmental performance. Many now realise that passive environmental strategies will lead to bad environmental performance, which could incur penalties or tarnish brand reputation, and eventually undermine the rights and interests of employees (Huang & Kung, 2010). Employees have high potential to cooperate with firms since their privileges and interests are inevitably linked with the firm's success (Elijido-Ten, 2011b). They are often the initiators and recipients of a firm's proactive environmental activities (Hanna, Newman & Johnson, 2000; Daily & Huang, 2001). Furthermore, firms with a larger number of employees are usually more structured to exercise their power via individual, group, labour union negotiations or a corporate agency (e.g. a special sector responsible for handling environment-related affairs). Such assurance of hearing and receiving employee pressures means that the firm may be more proactive in implementing environmental strategies that carry through to its social responsibilities. That is, the more employees there are, the greater the influence they have on policies including environmental management. For example, employees may demand a higher degree of transparency on environmental information to avoid compromising their own rights and interests (Huang & Kung, 2010). In this study, the proxy for EMP is calculated by taking the natural log of the number of employees.

[24] The threshold was initially set at 25 kilotons of carbon dioxide equivalents for corporations, and 125 kilotons for corporate groups, with further reductions in threshold levels for corporate groups planned for subsequent years (Clean Energy Regulator, 2012).

*Institutional investor (INS)* – Most institutional investors consider carbon emissions and other climate change risks while financially evaluating a company (Hassel, Nilsson & Nyquist 2005; Kolk et al., 2008; Leahy, 2008). Barnea, Heinkel and Kraus (2005) believed that investors take both financial and ethical considerations into account when they make investment decisions, and have the ability to influence the weight of investment within the individual firm. In line with this, other research has reported that many companies now need to report carbon emissions and other climate change information to attract investments (Heinkel, Kraus & Zechner, 2001; Barnea et al., 2005). Institutional investors increasingly exert pressure by demanding data on companies' emissions and related reduction strategies (Lash & Wellington, 2007; Stanny & Ely, 2008). In this regard, the growing scope of the CDP can be seen as a 'secondary stakeholder' that facilitates collaborative engagement by institutional investors to increase corporate accountability in relation to climate change (Arenas, Lozano & Albareda, 2009). Thus, the proxy for INS used in this study is the percentage of shares owned by the institutional investor in a particular sample company (Stanny & Ely, 2008).

*Media (MDA)* – Several studies have argued that the extent of environmental disclosure is not associated with the environmental performance of the firm (Ingram & Frazier, 1980; Wiseman, 1982; Rockness, 1985; Deegan & Rankin, 1996), but rather the external pressure exerted by society in general such as the media. Li, Richardson and Thornton (1997) reported that firms are more likely to disclose environmental information as propensity increases, and as outsiders' knowledge of their environmental liabilities increases. Such disclosure of environmental information has been perceived as self-laudatory, selective and intended to improve the firm's relationships among its stakeholders (Harte & Owen, 1992; Deegan & Rankin, 1996). Thus, it can be seen as a channel used by managers to attempt to influence public expectations and perceptions, to seek congruence between their own values and actions and those considered by society as appropriate (Guthrie & Parker, 1989; Patten, 1992; Deegan & Rankin, 1996). In line with this, it has been argued that the media has been particularly influential on corporate environmental responses (Brown & Deegan, 1998; Deegan, Rankin & Voght, 2000; Bansal & Clelland, 2004; Bansal, 2005). That is, the scope of media coverage influences the firm's level of visibility, including inviting further public attention. Hence, the media often plays a prominent role in corporate decisions to adopt CMS. In this study, the proxy

for MDA is defined as the total number of articles that include a statement about a company and its environmental issues (Bansal, 2005).

*Environmental non-government organisations (ENGOs)* – ENGOs often encourage entrepreneurial innovations (e.g. green products, closed loop technologies, waste reduction programs) and technological developments to address environmental problems (Stafford, Polonsky & Hartman, 2000). Using negative media publicity, ENGOs can insert pressure on firms to commit to sustainable development (Bansal, 2005). In addition, negative media coverage can provoke environmental interest groups and other stakeholders to lobby organisations and government to change business practices. In this study, the proxy for ENGO is a binary variable that equals 1 if any article portrays the company's environmental practices in a negative light, and otherwise 0.

In Equation (2), this study also uses firm size, leverage and industry as control variables:

*Firm size (FSIZE)* – Larger firms generally receive more attention from various societal groups and are therefore most often under greater pressure to disclose their social and environmental activities to legitimise their businesses (Stanny & Ely, 2008; Prado-Lorenzo et al., 2009). In addition, they generally have more shareholders who may be concerned with the firm's social and environmental practices (Cowen et al., 1987). Subsequently, as larger firms attract greater scrutiny from stakeholders, they are more likely to adopt CMS to mitigate carbon emissions. This study controls for firm size by using the natural log of the firm's total assets (Clarkson et al., 2008; Liao et al., 2015; De Villiers & Marques, 2016). The one-year lagged value of total assets is used consistent with prior relevant literature (Cornetta et al., 2008).

*Leverage (LEV)* – Leverage has been considered as a control variable for the possibility that highly leveraged firms provide greater levels of discretionary disclosures (Clarkson et al., 2008). The positive relationship between firm leverage and levels of environmental disclosure was supported by Alciatore and Dee (2006). In view of this, highly leveraged firms are more likely to adopt CMS to address creditors' expectations regarding climate change and related carbon emission issues. In this study, LEV has been measured as the ratio of total debt to total assets at the end of the fiscal year (Clarkson et

al., 2008; Rankin et al., 2011; Alrazi, De Villiers & Van Staden, 2016). It has been measured one year prior to the time window for which CMS adoption is identified to control for potential confounding effects or simultaneity bias (Bowen et al., 2008).

*Industry (INDY)* – It has been argued that the more attention one industry receives from stakeholders, the greater the incentives for companies in that industry to provide environmental disclosures (Deegan & Gordon, 1996; Bewley & Li, 2000). In this regard, environmental sensitivity is primarily driven by the potential (or actual) impact that the firms operating in a given industry may have (or have had) on the environment. With some exceptions (Alnajjar, 2000), empirical research has found that firms operating in environmentally-sensitive industries are more likely to disclose large amounts of social and environmental information (Patten, 1991; Roberts, 1992; Walden & Schwartz, 1997; Bewley & Li, 2000). Therefore, this study controls for the environmental-sensitivity of industries. Consistent with prior literature (Roberts, 1992; Clarkson et al., 2008; Liu & Anbumozhi, 2009), this study has considered energy, utilities, transportation, pharmaceuticals, materials (including mining) and telecommunications as environmentally-sensitive industries. Thus, INDY is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry, and 0 otherwise (Elijido-Ten, 2011a; De Villiers & Marques, 2016).

*Year dummies* – Four-year dummy variables are used and the definitions are similar to those used in Equation (1).

### 4.4.3 Models for testing hypotheses 3A and 3B

**Testing H3A** – The relationship between financial performance and CMS adoption is tested using the following regression equation:

$$FPRF_{it} = \beta_0 + \beta_1 CMS_{it} + \beta_2 FSIZE_{i(t-1)} + \beta_3 LEV_{i(t-1)} + B_4 GRTH_{it} + B_5 REG_{it} + B_6 INDY_i + B_{7to10} YEAR\ DUMMIES_i + \varepsilon_{it} \quad \text{.....Equation (3)}$$

Consistent with prior equations, the subscripts i and t in Equation (3) represent firm and year, respectively. The definitions of variables including the predicted sign for each variable in Equation (3) are presented in Table 4.6.

**Table 4.6: Definitions and measurements of variables for Equation (3) and Equation (4)**

| Variables | Descriptions | Hypotheses | Predicted sign |
|---|---|---|---|
| FPRF | Financial performance is the ratio of income before interest and tax to total assets. | | |
| CPRF | Carbon performance is the tons of carbon emissions per AUD$1 million of sales revenue. | | |
| CMS | Carbon management strategy (CMS) is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0. | H3A & H3B | + |
| FSIZE | Firm size is the natural logarithm of the firm's total assets. | H3A & H3B | +/- |
| LEV | Financial risk is the ratio of total debt to total assets at the end of fiscal year. | H3A & H3B | +/- |
| GRTH | Growth is the change in sales divided by prior year sales. | H3A & H3B | +/- |
| REG | Regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0. | H3A & H3B | + |
| INDY | Industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry, and otherwise 0. | H3A | ? |
| Year dummies | Four-year dummy variables that equal 1 if a company is selected for the year 2008, and otherwise 0; equal 1 if a company is selected for the year 2009, and otherwise 0; equal 1 if a company is selected for the year 2010, and otherwise 0; equal 1 if a company is selected for the year 2011, and otherwise 0. | | |

*Financial performance (FPRF)* - In constructing an empirical proxy for firm financial performance, this study has used the accounting-based measure of ROA. A generally accepted standard measure of financial performance, ROA measures the efficiency of assets in producing income (Cohen, Fenn & Konar, 1997). Most accounting-based indicators are subject to managers' discretionary allocations of funds to different project choices; they often reflect internal decision-making capabilities and managerial performance rather than external market responses to organisational (non-market) actions (Cochran & Wood, 1984; Albertini, 2013). ROA is the ratio of income before interest and tax to total assets (Walsh, 2010; Clarkson et al., 2011b; Elijido-Ten, 2011a; Cahan, De Villiers, Jeter, Naiker & Van Staden, 2016; Alrazi et al., 2016).

*CMS* – As in Equation (1), CMS is a dichotomous variable coded as 1 if the firm adopts one or more of the CMS criteria and coded 0 if it does not.

As shown in Equation (3), several firm characteristics are controlled for as follows:

*Firm size (FSIZE)* – It has been suggested that larger firms have fewer growth opportunities and more coordination problems, which may negatively influence their performance (Morck, Shleifer & Vishny, 1988). However, it has also been argued that larger firms more often make hefty investments and receive preferential treatment, which may enhance performance (Boeker, 1997). In this study, FSIZE is measured as a natural logarithm of total assets (Khan, Mather & Balachandran, 2014; Liao et al., 2015; De Villiers & Marques, 2016). The one-year lagged value of total assets is used consistent with prior relevant literature (Cornetta et al., 2008).

*Leverage (LEV)* – The leverage of a firm could lead to external corporate control (Chen & Jaggi, 2001). For example, debtholders will often actively monitor the firm's capital structure to protect their own interests (Hutchinson & Gul, 2004). Leverage therefore often influences firm performance via monitoring activities by debtholders and other external controls. However, a negative relationship can exist between such leverage and firm performance, whereby a firm prefers to fund operations via retained earnings rather than debt and equity (Myers, 1984). In this study, leverage has been measured as the ratio of total debt to total assets at the end of the fiscal year (Clarkson et al., 2008; Rankin et al., 2011; Cahan, et al., 2016). The variable has been measured one year prior to the time window for which financial performance is computed to control for potential confounding effects or simultaneity bias (Bowen et al., 2008).

*Growth* (*GRTH*) – Faster growth is more likely to be positively correlated with financial performance (Luo et al., 2013). Thus, the growth of a firm is often measured by the change in sales divided by prior year sales.

*Regulation (REG*) –The Australian NGER Act 2007 which took effect from 1 July 2008 stipulates that organisations need to be accountable for their carbon emissions via public disclosure of their emission levels (Lodhia & Martin, 2011). This study has controlled for the stringency of the regulatory environment in which the firm operates.

Regulation is a dichotomous variable where a value of 1 is awarded if a company is required to report carbon emissions under NGER Act 2007, and otherwise 0.

*Industry (INDY)* – Prior research has pointed out that certain industries such as those in oil, electronic, chemicals, pulp and paper, mining, electricity and utilities face more significant societal pressures due to their negative impact on the environment (e.g. Clarkson et al., 2008; Elijido-Ten, 2013). As noted earlier in Section 4.4.1 and in line with prior studies, the energy, utilities, transportation, pharmaceuticals, materials (including mining) and telecommunication industries have been categorised here as environmentally-sensitive industries. Thus, the environmental sensitivity of the industry is a dichotomous variable where a score of 1 is awarded to firms belonging to environmentally-sensitive industries, and 0 otherwise (Elijido-Ten, 2011a).

*Year dummies* – Four-year dummy variables are used and the definitions are similar to those used in Equation (1).

**Testing H3B** – The relationship between carbon performance and CMS adoption is tested using the following regression equation:

$$CPRF_{it} = \beta_0 + \beta_1 CMS_{it} + \beta_2 FPRF_{i(t-1)} + \beta_3 FSIZE_{i(t-1)} + \beta_4 LEV_{i(t-1)} + B_5 GRTH_{it} + B_6 REG_{it} + \beta_{7to10} YEAR\ DUMMIES_i + \varepsilon_{it} \quad \text{.....Equation (4)}$$

As in previous equations, the subscripts i and t in Equation (4) represent firm and year, respectively. The definitions including the predicted sign for each variable in Equation (4) are as presented earlier in Table 4.5.

*Carbon performance (CPRF)* - This study has used carbon intensity as a proxy for the firm's carbon performance which is measured as tons of carbon emissions per AUD$1 million of sales revenue (Busch & Hoffmann, 2011; Chapple et al., 2013). Carbon intensity relates to a company's physical carbon performance and is described as the extent to which an entity's business activities are based on carbon usage for a defined scope and fiscal year.

In this study, the carbon emissions data were collected from the Clean Energy Regulator website. Firms reported their carbon emissions (measured in metric tons) broken down by Scope, i.e. Scope 1 (direct emissions) and Scope 2 (indirect emissions, such as from electricity utilisation). Consistent with Busch and Hoffmann's (2011) study, to harmonise the measurement scales with the other input variables of the model, the following two steps were taken here: (1) the natural logarithm of the obtained carbon intensity was taken; and (2) the resultant rescaled carbon intensity was multiplied by (–1). The second step was necessary to show that a low value for carbon intensity corresponds with better carbon performance.

*CMS* – As in Equation (1), CMS is a dichotomous variable coded as 1 if the firm adopts one or more of the CMS criteria and coded 0 if it does not.

In Equation (4), this study has used financial performance, firm size, leverage, growth and regulation as control variables, and the definitions of these are similar to those used for Equation (3).

## 4.5 CHAPTER SUMMARY

This chapter has presented the sample data and the research approach used to test the nine hypotheses developed in Chapter 3. An overview of the measures of CMS adoption used in previous research is provided together with a detailed discussion of the content analysis method used in this study. The chapter concludes with an explanation of the empirical models as well as corresponding estimation methods related to testing all the hypotheses in answering the three main RQs introduced in Chapter 1. The next Chapter 5 examines the different types of CMS adopted by Australia's top 200 ASX-listed firms (i.e. RQ1).

# *CHAPTER 5*

# DIFFERENT TYPES OF CMS ADOPTION

## 5.1 INTRODUCTION

Chapter 4 outlines both the qualitative and quantitative methods adopted in Phase 1 and Phase 2 of this study. The purpose of this chapter is to discuss the results of Phase 1 related to RQ1: What are the various types of CMS adopted by ASX 200 publicly-listed companies? This chapter is structured into four sections. In Section 5.2, carbon management strategic types are discussed, while Section 5.3 provides example of various carbon management activities. This is followed by Section 5.4 which presents a discussion of the findings in relation to CMS adoption. The chapter is then summarised in Section 5.5.

## 5.2 CARBON MANAGEMENT STRATEGIC TYPES

Consistent with prior literature, this study has identified three main types of CMS: (1) compensation strategy; (2) reduction strategy; and (3) all-rounder strategy. A company is considered as adopting compensation strategy if it participates in any regional and/or international ETSs to increase emission limits by purchasing emissions allowances. This strategy reflects a reactive posture to carbon emissions, and is equivalent to Hart's (1995) end-of-pipe approach – a reactive posture to environmental issues, whereby limited resources are committed to solving environmental problems. Compensation strategy is also similar to the 'cautious reducer' (Lee, 2012), 'compensators' (Weinhofer & Hoffmann, 2010), 'beginner' (Jeswani et al., 2008), 'reactive strategy' (Buysse & Verbeke, 2003) and 'emergent planners' (Kolk & Pinkse, 2005) clusters identified in prior research.

In contrast, firms that employ reduction strategy are more proactive in their management of carbon emissions. They set clear carbon reduction targets and prepare clear measures to achieve them (e.g. investment plans). Many also consider increasing carbon emissions efficiency by substituting input factors or modifying products or

production processes to actually reduce carbon emissions. Activities that fall within this strategy imply a certain level of internal change, such as making production processes more carbon-efficient or collaborating with suppliers to reduce carbon emissions. Firms with reduction strategy also enhance their competitiveness by developing more energy-efficient and less carbon-intensive products. Reduction strategy is similar to the 'product enhancer' (Lee, 2012), 'reducers' (Weinhofer & Hoffmann, 2010), 'emerging' (Jeswani et al., 2008), 'pollution prevention' (Hart, 1995; Buysse & Verbeke, 2003), and the 'internal explorer' and 'vertical explorer' (Kolk & Pinkse, 2005) clusters identified in prior research.

Finally, firms that adopt all-rounder strategy are more similar to Hart's (1995) sustainable development strategy which aims to minimise the negative environmental burden of firm growth through the development of green competencies. Firms with all-rounder strategy engage in a number of carbon management activities such as greener products development, emission reduction in the production process, and invest in energy-efficient projects (Lee, 2012). These firms' main emphasis is to maintain and enhance competitiveness in their current markets. All-rounder strategy is also similar to the 'all-round explorer' (Lee, 2012), 'all-rounders' (Weinhofer & Hoffmann, 2010), 'active' (Jeswani et al., 2008), 'environmental leadership' (Buysse & Verbeke, 2003) and 'emissions traders' (Kolk & Pinkse, 2005) clusters identified in prior research.

In this study, the content analyses of the CDP surveys and publicly-available reports revealed that more than half of the sample firms have adopted a CMS (see Table 5.1). The results show an increasing trend in the number of firms adopting CMS over the five years covered in this study, from 2008 to 2012. The number of CMS adopters ranges from 62.00% (124 out of 200) in 2008 to 72.50% (145 out of 200) in 2012.

Table 5.1 also shows that few of these companies adopted compensation strategy. Only 2.76% of the sample firms (4 out of 145) adopted this strategy in 2012, which has steadily declined across the research period. In contrast, reduction strategy was the dominant category in CMS adoption over the five-year period. The number of companies adopting reduction strategy ranges from 82.25% in 2008 (102 out of 124) to 82.07% in 2012 (119 out of 145). With regard to all-rounder strategy, less than one-quarter of the sample firms adopted this CMS type across the five-year period; although it did increase from 11.29% in 2008 (14 out of 124) to 15.17% in 2012 (22 out of 145).

**Table 5.1: Number of sample firms that have adopted CMS**

| CMS adoption type | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Compensation strategy | 8 (6.45%) | 7 (5.38%) | 7 (5.10%) | 6 (4.20%) | 4 (2.76%) |
| Reduction strategy | 102 (82.25%) | 106 (81.54%) | 111 (81.02%) | 117 (81.81%) | 119 (82.07%) |
| All-rounder strategy | 14 (11.29%) | 17 (13.07%) | 19 (13.87%) | 20 (13.98%) | 22 (15.17%) |
| Total of Companies with CMS | 124 (62.00%) | 130 (65.00%) | 137 (68.50%) | 143 (71.50%) | 145 (72.50%) |
| Companies without CMS | 76 (38.00%) | 70 (35.00%) | 63 (31.50%) | 57 (28.50%) | 55 (27.50%) |
| Total (1,000) | 200 | 200 | 200 | 200 | 200 |

This study has classified different CMS adoption types based on specific decision criteria: participation in ETS; purchasing emissions allowance; designing new carbon-efficient products; making existing products/services carbon-efficient; making existing production processes carbon-efficient; carbon-efficient supply chain management; and investing in energy-efficient projects. All of these criteria have already been discussed in Section 4.3.2 in relation to the content analysis employed in this study.

Table 5.2 shows the percentage of firms that fall under each of the decision criterion for five-year period. These results reveal that 95.00% of the sample companies that adopted compensation strategy participated in regional or international ETS, whereas 72.00% of the compensation strategy adopters increased their emissions limits by purchasing an emissions allowance.

Among the reduction strategy adopters, making existing production processes carbon-efficient was the dominant approach (94.78%) of firms, followed by investing in energy-efficient projects at 86.87%. In contrast, only 26.98% of these firms reduced emissions through carbon-efficient supply chain management. Furthermore, only 12.95% of the companies adopted reduction strategy by designing new carbon-efficient products. Overall in relation to reduction strategy, making existing products/services carbon-efficient was the least used approach (10.07%).

In terms of all-rounder strategy, investing in energy-efficient projects and participation in ETS were the principal approaches taken (93.41% and 93.33% respectively). Moreover, 89.01% of all-rounder strategy adopters mitigated carbon emissions by making existing production processes carbon-efficient. The results also revealed that 67.49% of the companies that adopted all-rounder strategy increased emissions limits by purchasing emissions allowances. Furthermore, 37.36% of all-rounder strategy adopters reduced carbon emissions via carbon-efficient supply chain management, and 24.18% via the design of new carbon-efficient products. Similar to reduction strategy, making existing products/services carbon-efficient was the least used approach (16.48%).

**Table 5.2: Different approaches of CMS adoption**

| Decision criteria | Compensation strategy | Reduction strategy | All-rounder strategy |
|---|---|---|---|
| Participation in ETS | 95.00% | NA | 93.33% |
| Purchasing emissions allowance | 72.00% | NA | 67.49% |
| Designing new carbon-efficient products | NA | 12.95% | 24.18% |
| Making existing products/ services carbon-efficient | NA | 10.07% | 16.48% |
| Making existing production processes carbon-efficient | NA | 94.78% | 89.01% |
| Carbon-efficient supply chain management | NA | 26.98% | 37.36% |
| Investing in energy-efficient projects | NA | 86.87% | 93.41% |

From these findings, it was deemed valuable to examine the various carbon management activities undertaken by sample firms and how they met the decision criteria. This additional analysis showed strong similarities among carbon management activities undertaken by the firms. Thus, some examples of similar carbon management activities from each decision criterion have been selected and these are discussed further in the following section.

## 5.3 EXAMPLES OF SIMILAR CARBON MANAGEMENT ACTIVITIES

### 5.3.1 Participation in ETSs

Firms acquire additional carbon emissions capacity by participating in ETSs. The following examples are provided.

*Boral Limited*: Boral Limited, Australia's largest construction and building material supply company, participates in the New South Wales Greenhouse Gas Reduction Scheme (NSW GGAS). The NSW GGAS is an Australian state-level program designed to reduce GHG emissions associated with the production and use of electricity; and to develop and encourage activities to offset the production of GHG emissions (New South Wales Greenhouse Gas Reduction Scheme, 2010). Boral Limited was liable for 6,1738 tons per capita in 2012, which was the amount of GHG emissions above the defined baseline for 2011 (Boral Limited, 2012, p. 24).

*CFS Retail Property Trust Group:* CFS Retail Property Trust Group, an Australian independently-managed retail property group, is a voluntary participant to the Energy Savings Scheme (ESS) and is an approved Accredited Certificate Provider (ACP). The ESS is a New South Wales Government initiative that aims to reduce electricity consumption by creating financial incentives for energy-saving activities. The parties that create these energy savings certificates (ESCs), for subsequent purchase by scheme participants, are known as ACPs and are voluntary participants in the ESS. CFS Retail Property Trust Group has been investigating all energy-efficiency projects undertaken since 1 July 2008 of its NSW assets, to determine the number of certificates these activities may be qualified to generate. Similar to ESS in NSW, the group has also been reviewing the introduction of the Victorian Energy Efficiency Target (VEET) Scheme in the state of Victoria. As this scheme is similar to NSW Government's initiative, it is the CFS Retail Property Trust Group's intent to also claim these certificates from energy-efficiency projects implemented within its Victorian portfolio of assets.

*Stockland Corporation Limited*: Stockland Corporation Limited is a diversified property group within Australia which develops, owns and manages retail centres, business parks, logistics centres and office buildings. It is a voluntary participant in the

NSW ESS. It successfully applied for accreditation in respect of eligible recognised energy savings activities in 2010, and then began creating ESCs by implementing energy-efficiency projects in its office buildings.

*Westpac Banking Corporation*: Westpac Banking Corporation (WBC), one of Australia's 'big 4' banks, has been trading voluntarily in the EU-ETS since 2006, and completed its first trade under the proposed AETS in 2008 (CDP Survey, 2012). WBC is also the first bank to trade on the New Zealand ETS (NZ ETS) in 2008. It is heavily focused on financing new carbon-related business opportunities for customers.

*Origin Energy*: Origin Energy is an integrated energy company focused on gas and oil exploration and production, power generation, and energy retailing within Australia. It participates in the NZ ETS in 2010, and reporting obligations commenced on 1 January 2011. The reporting obligation period is from 1 July to 31 December, and transition specifications for that period require one permit to be settled for every 2 tons of carbon emissions produced. (Origin, 2012, p. 13)

*National Australia Bank*: National Australia Bank (NAB) is a registered participant in the United Kingdom's CRC Energy Efficiency Scheme[25]. NAB first participated in the scheme in 2008, and reported its emissions for the first time in July 2011. It purchased allowances at £12 per ton of carbon dioxide (CDP Survey, 2012), and the sale of allowances occurred between 1 June 2011 and 31 July 2012. NAB purchased the number of allowances based on their 2011/12 emissions.

### 5.3.2 Carbon offset initiatives

Carbon offset initiatives relate to firms' investments in carbon emissions offsetting projects. Some relevant examples from the sample companies are discussed below:

*Qantas Airways Limited*: Qantas Airways Limited has grown to be Australia's largest domestic and international airline. The Qantas Group Carbon Offset Program has collected and invested over AUD$8 million dollars and saved around 1.2 million tons of

[25] This involves mandatory carbon emissions reporting and a corresponding pricing scheme to cover large public and private sector organisations in the United Kingdom that use more than 6,000 MW per year of electricity and have at least one half-hourly metre settled on the half-hourly electricity market (Carbon Trust, 2015).

carbon emissions from 2008 to 2011 (Qantas, 2012, p. 23). It also entered into an agreement in 2010 to purchase carbon credits from RM Williams' Henbury Station[26] property in Central Australia. Credits from Henbury Station support the voluntary carbon offset and are used to offset part of Qantas's carbon price liability. Furthermore, Qantas Airways Limited has invested in various offset programs certified under the Australian Government National Carbon Offset Standard, such as the Carbon Neutral Program which provides customers with the ability to fully offset the carbon emissions of their flights. The program supports energy projects including wind farms, efficient cook-stoves, small hydropower developments and 'fuel switching' projects.

*Origin*: As an integrated energy company, Origin's operations span exploration, production, generation and the sale of energy to millions of households and businesses across Australia. Origin's target has been to offset 100% of GHG emissions from its non-energy producing sites, such as emissions related to commercial offices as well as car and air travel. This target was consistently achieved between 2008 and 2011 through a mix of accredited GreenPower and eligible voluntary offset certificates under Origin's Carbon Pollution Reduction Scheme. For example, Origin purchases accredited GreenPower products to offset 10% of the GHG emissions associated with electricity consumption in its offices, shops and LPG terminals (Origin, 2012, p. 13). For the remaining 90% of carbon emissions, as well as all those from business travel, carbon offsets are sourced from accredited projects under Origin's Carbon Pollution Reduction Scheme. The organisation offsets 90% of carbon emissions from its non-energy producing sites via voluntary offset certificates, and the remaining 10% are offset via GreenPower (Origin, 2012, p. 14).

*Crown Limited*: Crown Limited is Australia's leading integrated resort company. Crown Melbourne introduced a carbon offset program for hotel guests in 2010. This program has achieved certification under the Australian Government's National Carbon Offset Standard, which is a first in the hospitality and entertainment industry within Australia. As a partner of Climate Friendly[27], Crown provides customers with the

[26] Henbury Station is a former pastoral property being regenerated to restore natural vegetation and remove carbon dioxide from the atmosphere (ABC, 2013).

[27] Climate Friendly is a pioneer in providing innovative carbon management solutions by investing in renewable energy projects that effectively keep carbon where it belongs in the ground. It is consistently rated at the top of its field in local and international surveys for the quality of its carbon solutions (Climate Friendly, 2015).

opportunity to voluntarily offset their hotel stay, function or conference event. Crown's carbon offset program allows customers to 'opt in' to offset their visit to Crown, and Crown then offsets the emissions by purchasing carbon credits from wind farm projects (Crown Limited, 2012).

*PMP Limited*: PMP Limited is a media and marketing company, providing a range of services from concept through to fulfilment. PMP Limited offsets 50% of its electricity emissions through GoldPower[28] purchases (PMP Limited, 2012, p. 27). It also offsets all petrol emissions by planting trees through Greenfleet Australia[29].

### 5.3.3 Product development

In the context of carbon management activities, product development relates to firms designing new carbon-efficient products, such as the following examples described by various firms in the sample.

*Caltex Australia Limited*: Caltex Australia Limited develops biofuels which play a significant role in reducing GHG emissions, as they have lower carbon intensity than fossil-fuel-derived products. The Caltex biofuels includes Bio E10 Unleaded, Bio E-Flex and B2 biodiesel blends. The Caltex biodiesel blends of B2, B5 and B20 consist of diesel blended with biodiesel, which is made from cooking oil, canola oil and tallow. Another main product of Caltex is ethanol, which helps to reduce GHG emissions compared with petrol as it generates fewer emissions over its full lifecycle, including the growing of its crops, manufacturing the ethanol, transporting it to the pumps and using it in vehicles. Ethanol results in 18% to 46% less GHG emissions than petrol on a full lifecycle basis (Caltex Australia Limited, 2012).

*Rio Tinto*: Rio Tinto is a mining company that has introduced new fuel-saving engine software to hydraulic excavators in 2011. This software reduces GHG emissions from the excavators by 1,900 tons per year. The principles of the software – Fuel

[28] GoldPower is the world's first global renewable energy label. GoldPower label provides a guarantee that the renewable energy is truly transforming the way the world creates electricity. It is a renewable energy certificate for leading businesses who want to demonstrate their commitment to supporting the overall transition to a sustainable electricity future (GoldPower, 2015).

[29] Greenfleet is Australia's first carbon offset provider. Since 1997, it has planted more than 8.6 million native trees across 400 bio diverse forests in Australia and New Zealand to offset carbon emissions on behalf of thousands of leading brands, businesses, councils, universities, NGOs and individuals (Greenfleet, 2015).

Economy Optimised Engine Calibration – have since been successfully trialled in more than 130 Komatsu 830E trucks across Rio Tinto sites in 2011. The software alters the way diesel is introduced to the engine so that fuel is burnt at a higher combustion temperature and is used more efficiently (Rio Tinto, 2012, p. 17).

*NAB*: NAB has developed innovative financial products and services to help its customers adapt to and manage the risks associated with climate policy and impacts in 2010. For example, it has innovated a funding source for environmental retrofits of commercial buildings in collaboration with Low Carbon Australia and Eureka Funds Management, which is known as Australia's first environmental upgrade agreement. The bank also offers asset finance solutions for energy-efficient products (e.g. LED lighting and solar systems), and the financing of forestry developments specifically targeting carbon sequestration. NAB also offers project finance for renewable energy generation projects.

*Origin*: Australian energy company Origin is recognised as a leader in the sale of low-carbon-intensity products. It is the leading green energy retailer, a leading installer of rooftop solar Photovoltaic systems, and has been at the forefront of the installation of cogeneration and trigeneration plants to deliver cleaner and more efficient energy for commercial buildings. Origin develops innovative and sustainable energy solutions to empower customers in making choices about their energy use and management. Furthermore, it has announced a partnership with Nissan in 2011 as the preferred electro mobility operator (EMO) for its new electric car, the LEAF. The Nissan LEAF will be the world's first purpose-built, family-sized electric passenger car, and as EMO for the LEAF, Origin provides charging equipment and services, and 100% green power for charging as well as smart electricity management and advice. As a result, customers can more dramatically reduce their car's carbon emissions compared with a petrol car which on average would produce approximately 3,038 kilograms of CO2e per year (Origin, 2012, p. 10). Origin continues to lead the market in Australia in the development of low-carbon and renewable energy products, and together with Nissan has further aims to encourage a less oil-dependent motoring culture in Australia.

### 5.3.4 Product improvement

Product improvement in relation to carbon management involves firms making existing products more carbon-efficient. Some relevant examples are provided below:

*Coca-Cola Amatil*: Coca-Cola Amatil (CCA) is one of the largest beverage and food manufacturing companies in the Asia-Pacific region. As part of its carbon management activities within Australia and the surrounding region, since 2008 it has used the Mount Franklin easy-crush bottle product, which contains 35% less plastic than before (Coca-Cola Amatil, 2012b, p. 128).

*Woolworths*: Woolworths is continuously seeking innovative and commercially-realistic solutions to reduce its environmental footprint. As part of this, it has invested in a range of new technologies to reduce energy usage and associated GHG emissions. For example, Woolworths has more than 3,300 own-brand products which generate about 32,600 tons of packaging (Woolworths Limited, 2012, p. 54). In 2011, Woolworths improved its 600-millilitre own-brand water bottle to make from 50% recycled polyethylene terephthalate (PET) plastic. This meant that at least 300 tons of recycled PET plastic was now being re-used (Woolworths Limited, 2012, p. 55). At the same time, Woolworths changed the meat trays on 18 of its products to contain at least 90% recycled PET plastic. More than 500 tons of recycled PET are annually used and the generation of this recycled PET plastic has produced 70% less carbon emissions compared with virgin PET (Woolworths Limited, 2012, p. 56).

*Qantas Airways Limited:* Qantas Airways Limited has increased its fuel efficiency by replacing older aircraft with new, more fuel-efficient aircraft in 2011, including next generation aircraft such as the Airbus A380, Boeing 787 Dreamliner, and Airbus A320neo. Qantas has also invested in the Bombardier Q400 for regional routes, which consumes 35% less fuel than similar-sized jet aircraft (Qantas, 2012, p. 42). The replacement of older aircraft with new, more fuel-efficient aircraft has resulted in a reduction in the average scheduled passenger fleet age since 2008. Qantas Airways Limited continues to implement world-class fuel-efficiency improvements via improved flight procedures and optimised flight planning.

### 5.3.5. Process modification

Process modification to address CMS is often categorised as the upgrading of existing production processes to ensure they are more carbon-efficient or changing the process technology to improve the GHG inventory. Some relevant examples of process modification by Australian firms in the sample are as follows:

*WBC*: WBC continues to focus on the delivery of process improvements to improve its overall customer experience in relation to CMS, including moving 630,000 of its existing and new customers to e-statements. Since this process modification was launched in 2005, approximately 1.5 million customers have opted to receiving e-statements; thereby helping save AUD$7,753,020.64 and 410.65 tons of paper. Furthermore, this has contributed to an emission saving of approximately 1,026.62 tonnes (CDP Survey, 2012).

*NAB*: Since 2010 NAB's personal banking customers have had the option of receiving their account information via electronic 'e-statements'. As at 30 September 2011, around 1,012,000 NAB customers in Australia had opted for these paperless statements. This has reduced NAB emissions by around 210 tons of carbon per annum (National Australia Bank, 2012). NAB also provides assistance to business clients to reduce their carbon footprint and to help them understand the implications of the changing carbon policy landscape.

*BHP Billiton:* Natural resources company BHP Billiton is increasingly using the common practice of 'green completions' to reduce GHG emissions, which involves capturing and selling natural gas that may otherwise have been vented or flared. In line with its corporate target to mitigate carbon emissions, a number of abatement opportunities have been implemented across the firm's operations since 2008. For example, the drilling fleet has been upgraded in 2011 so it is more operationally-efficient. Electrical drives are now introduced on new drilling rigs, which are powered by clearer burning engines. In addition, the new technology of using dual-fuel on drilling rigs and fracturing pumps burns natural gas and diesel simultaneously; hence reducing carbon emissions (BHP Billiton Limited, 2012).

*Caltex Australia Limited*: Besides being a transport fuel supplier and convenience retailer in Australia, Caltex Australia is the only integrated oil refining and marketing company listed on the ASX. In 2010, Caltex Australia Limited upgraded its Lytton Refinery reformer unit, which contributed to a reduction in its Scope 1 carbon emissions. Such process modification activities resulted in reported reductions of 2959 tons of carbon emissions in 2011 (CDP Survey, 2012).

*CCA*: Since 2009, CCA has saved 55,550 KW per annum (carbon = 49.5 tons of CO2e) by downsizing beverage container warmer pumps and improving beverage line insulation. In addition, it has saved 10052 GJ of gas (carbon = 516t CO2e) by replacing the boilers for site steam (CDP Survey, 2012).

*APA Group:* APA Group is a natural gas infrastructure business which supports reducing carbon emissions as responsible risk mitigation for offsetting climate change. APA reduces its own carbon emissions via gas-fired and wind-powered generation. Gas-fired generation has played an increasingly important role as back-up generation to intermittent renewables such as wind and solar. For example, combined-cycle gas turbine (CCGT) generation is a mature technology that uses Australia's substantial gas reserves to produce electricity that has one-third the emissions intensity of brown coal and one-half that of black coal. In relation to wind-powered generation, the 132 MW North Brown Hill wind farm owned by APA Group is expected to save 355,000 tons of carbon emissions each year for 25 years – a total of 8,875,000 tons; while the 79 MW Emu Downs wind farm is expected to annually save 232,000 tons of carbon emissions for 25 years – a total of 5,800,000 tons. Furthermore, the 242 MW Diamantina Combined Cycle Gas Power Station owned by APA Group is expected to save 840,000 tons of carbon emissions each year for 25 years – a total of 21,000,000 tons (APA Group, 2012, p. 27).

*Brambles Limited*: Brambles Limited is a supply chain logistics company primarily operating through the CHEP and IFCO brands. As part of its GHG reduction plan, CHEP installed a biomass boiler in its Belpuig service centre, which was expected to cut the site's emissions by 36% (Brambles Limited, 2012, p. 21). Furthermore, in 2011 CHEP identified air leaks and developed corrective action plans, both to save energy and to improve overall operational effectiveness. Each site subsequently reduced its compressed air leaks during the year, saving approximately 250 tons of CO2e emissions. The next

stage was to optimise the network and install new compressors where necessary, with an expected further reduction of approximately 840 tons of CO2e emissions annually (Brambles Limited, 2012, p. 22).

*Crown Limited*: The integrated resort company Crown Limited, with funding assistance from the Australian Packaging Covenant, installed 380 recycling bins across the Melbourne complex, resulting in more than 300 tons of waste being diverted from landfill each year, and reducing CO2 emissions by 36 tons per annum (Crown Limited, 2012, p. 28). Another process modification initiative in 2012 was the soft plastic recycling scheme which runs in partnership with the Red Group[30]. This scheme has ensured that all plastic wrapping that arrives in the loading dock at the complex is collected every day and recycled into outdoor furniture, signage and other items (Crown Limited, 2012).

*Virgin Australia*: Virgin Australia trialled biodiesel in some of its ground service equipment in 2011 at Brisbane Airport – a first for an Australian airline. The trial involved using a biodiesel blend derived from locally-sourced tallow and used cooking oil (split 20:80 conventional petrol-diesel) in a ground support service (e.g. baggage tug and a push-back) vehicle at Brisbane Domestic Airport over an eight-week period. Virgin Australia then commenced the roll-out of biodiesel to all ground service equipment in Brisbane, prior to introducing to its other main airports (i.e. Adelaide, Melbourne and Sydney). This has led to a reduction of over 300 tons of CO2e per year, and reduced GHG-related net emissions by 20% (Virgin Australia, 2012, p. 29). In addition, both the maintenance facilities in Melbourne and Brisbane were assessed in 2012 for opportunities to reduce electricity consumption. At the Melbourne Jet Base, the subsequent installation of skylights vastly increased natural light and reduced the need for lighting during the day. Daylight sensors were then installed that switch off hangar lighting when there is sufficient natural light available. At the more modern Brisbane hangar, a number of initiatives were also implemented to improve the efficiency of the air conditioning system, which was predicted to save approximately 150,000 KW and 132 tons of CO2e per year. A trial of energy-efficient high bay lighting has also commenced at the Brisbane hangar (Virgin Australia, 2012, p. 31).

[30] The RED Group, a Melbourne – based consulting and recycling organisation, has developed and implemented an innovative closed-loop recycling initiative, the REDcycle program that makes it easy for Australian consumers to play their part in creating a sustainable future (REDcycle, 2015).

### 5.3.6 Carbon-efficient supply chain management

Carbon-efficient supply chain management is a key area for enhancing firm efficiency and reputation, and meeting corresponding regulations. Companies that have a full understanding of their carbon emissions, including their suppliers and customers, are better able to measure, manage and reduce them. Carbon-efficient/green supply chain management practices include reducing packaging and waste, assessing vendors on their environmental performance, developing more eco-friendly products, and reducing carbon emissions associated with the transportation of goods. Carbon-efficient supply chain management enables businesses to leverage reputational benefits including communicating their carbon management actions to stakeholders, which could set them apart from the competitors. Some examples of carbon-efficient supply chain management activities are outlined as follows:

*Qantas Airways Limited*: Qantas Airways Limited has focused on more sustainable jet fuel since 2008 to tackle the environmental and energy security issues associated with traditional fossil-based fuels. It has used its significant power in fuel purchasing to influence the development of a Sustainable Aviation Fuel (SAF) supply chain within Australia. This second generation biofuel was produced by its supplier SkyNRG, derived from used cooking oil split 50:50 with conventional jet fuel. The lifecycle carbon footprint of SAF is approximately 60% lower than that of conventional jet fuel (Qantas, 2012, p. 23).

*BHP Billiton:* BHP Billiton works in partnership with vehicle and equipment manufacturers to improve the overall efficiency of fuel and lubricant products. It has also collaborated with its truck partner Caterpillar to develop an integrated clean fuels program that enhances engine performance in the company's fleet, improving engine performance and reducing GHG emissions (BHP Billiton Limited, 2012).

*Virgin Australia*: Virgin Australia works in partnership with Airbus, General Electric, and Renewable Oil Corporation to produce renewable fuel from the sustainable harvesting of Eucalyptus Mallee trees grown in the Western Australian wheat belt[31]. These partnerships aim to develop a complete sustainable aviation biofuel production chain in

[31] This wheat belt region is one of nine within Western Australia, and partially surrounds the Perth metropolitan area.

Australia, using only renewable resources. Its primary objective is to establish a sustainable biomass supply chain to feed a commercial renewable fuel facility (Virgin Australia, 2012).

*PMP Limited*: Media and marketing provider PMP Limited has developed an environmental procurement embedded in its own organisation's process in 2010. This process creates value by considering environmental factors in the total cost of ownership. The policy includes preparing transparent and accurate sustainability profiles for major suppliers, and creating strong relationships with suppliers to drive continuous improvement. In addition, PMP Limited conducts site audits of its own suppliers to ensure best-practice processes are being adhered to (PMP Limited, 2012).

*Brambles Limited*: Brambles Limited is a supply chain logistics company. Brambles Limited regularly engages with its suppliers to assess whether their practices are in line with its environmental principles, and acts accordingly to help those suppliers meet these requirements. It works to reduce its environmental footprint by using its logistics knowhow to minimise the footprint of its suppliers and the supply chain through network optimisation, which reduces transport distances and associated emissions. As part of this, CHEP's (core brand of Brambles) Total Pallet Management program allows it to manage all of a customer's pallet needs onsite and supply its pallets without the need for additional transport. Customers' use of Total Pallet Management also reduces the energy requirements associated with the pallet pool (Brambles Limited, 2012).

### 5.3.7 Energy-efficiency initiatives

Energy-efficiency initiatives relate to the implementation of energy-efficient projects, such as substituting existing energy sources with cleaner fuels and reducing direct GHG emissions (Lee, 2012). Within an Australian context, some relevant examples of energy-efficiency initiatives are as follows:

*Virgin Australia*: Virgin Australia's strategic approach towards climate change is mainly focused on fuel efficiency and sustainable aviation fuel development. For example, it has invested in a fleet program in 2009 to ensure it operates as a fuel-efficient fleet; reducing the average age of its aircraft to just 4.2 years, down from 4.9 at the end of 2011. To further improve efficiency, the airline has instituted a program to evaluate fuel reduction opportunities. Such effective fuel management requires a cross-divisional

approach, as all operational areas have an impact on the way that aircrafts consume fuel. A cross-divisional team was therefore established in 2010 and led by the general manager of flight operations that focuses on a core set of fuel management principles including: optimising fuel policy and flight planning; reducing aircraft weight; operational process excellence; and working proactively with air navigation service providers to find efficiency opportunities in the air traffic control system. To further support the target of sourcing 5% of its aircraft fuel requirements from renewable jet fuel by 2020, it has also cemented two key partnerships with advanced biofuel companies in 2011. Virgin Limited has anticipated that renewable jet fuel will continue to play a major role in reducing its carbon emissions in the future (Virgin Australia, 2012, p. 29).

*Boart Longyear*: Boart Longyear is a mineral exploration drilling equipment and services company. As part of its energy-efficiency initiatives, it has invested in global fleet modernisation with high-efficiency engines, along with concurrent retirement of older, less efficient engines. It has also completed hazardous materials inventories and minimisation efforts at all of its global manufacturing facilities and drilling services facilities. In addition, it has constructed multiple new drilling services support facilities such as employing an architectural template incorporating LEED™[32] design elements. In 2011 Boart Longyear installed of a high-efficiency electric induction heating coil system. It has reduced annual natural gas consumption by 3.1 million cubic metres and carbon-equivalent GHG emissions by 7,000 tons, which is equivalent to taking 1,200 passenger vehicles permanently off the roads (Boart Longyear Limited, 2012, p. 13).

*Macarthur Coal Limited*: Macarthur Coal Limited (MCC) is a mining company with core activities including exploration, project evaluation and development, mining, and the marketing of metallurgical coal. In 2010, MCC implemented an efficient lighting plant with automatic start/stop, lighting controls for key buildings, and a high-performance excavator coal bucket, which were collectively expected to reduce diesel consumption by over 50,000 litres per annum (Macarthur Coal Limited, 2012, p. 50).

*Brambles Limited*: Brambles Limited is a supply chain logistics group specialising in the pooling of unit-load equipment and associated services. As part of its energy-

[32] The Leadership in Energy and Environmental Design (LEED™) is a third-party certification program. It provides guidelines for designing, constructing, operating and certifying the world's greenest buildings (U.S. Green Building Council, 2016).

efficiency initiatives, in 2009 it installed new T5 fluorescent lighting in some of its service centres, with an expectation of a significant reduction in energy usage in comparison with the previous metal halide lighting. CHEP (core brand of Brambles) achieved a 2.2% reduction in 2010, a total of 516 tons of CO2e. CHEP was subsequently recognised by the NSW Government's Sustainability Advantage program since 2009 for its commitment to sustainability, including these energy-efficiency initiatives (Brambles Limited, 2012, p. 21).

*WBC*: As part of its energy-efficiency initiatives, WBC invested in energy-efficient upgrades at all of its branches and offices in 2008, as well as the closure of inefficient office space, which resulted in a decrease of Scope 1 and 2 emissions. These upgrades included replacing lighting with LEDs and the replacement of old air conditioner units with more energy-efficient models (CDP Survey, 2012).

*CCA*. In 2010 CCA invested in energy- and water-saving technologies for the new Bluetongue Brewery in New South Wales. The investment ensures onsite generation of biogas through beer processing, which is captured and used as fuel elsewhere on site. This also enables the use of a waste product, reducing natural gas consumption and cost to the business. In 2011 another energy-efficiency initiative was the development of 670 solar panels on the roof of the new Eastern Creek Distribution Centre in New South Wales. This facilitated the reduction of 150 tons of GHG emissions annually, and the green production of 15% of the building's energy needs (Coca-Cola Amatil, 2012a, p. 128). Thus, CCA reduced its annual electricity costs. In Australia, the company has also relocated its head office in 2011 from Circular Quay to a North Sydney five-star, green-rated office. Some of the green elements in the new office include wastewater recycling, trigeneration power, automated lighting systems, stairwells, and maximum use of natural light.

*Caltex Australia Limited*: As part of contribution to energy-efficiency initiatives, Caltex Australia continued to drive improvements in energy efficiency across its refineries and service station network in 2012. With retail service station sites across Australia typically operating 24 hours a day, 365 days a year, energy savings from lighting upgrades and building energy management systems deliver both operational cost savings and reduced greenhouse gas emissions across their network (Caltex Australia Limited, 2012).

## 5.4 DISCUSSION OF PHASE 1 FINDINGS

This study examines CMS adoption through the lens of RBV in terms of its four classic indicators: valuable, rare, imperfectly imitable, and non-substitutable. A resource is considered strategic if it meets the above-mentioned criteria (Barney, 1991; Crook et al. 2008). First, the internal capability becomes a valuable resource when firms develops internal capabilities and applies these to the appropriate external environment (Barney, 1991). Having the capability to design new products that emit less carbon or improving existing products to be carbon free during their production and use would be a valuable resource (Lee, 2012). CMS adoption allows a firm to be viewed as responsible and compliant by society, which in turn can generate additional revenues from customer loyalty. Thus CMS adoption can be treated as a valuable resource that can be used within a firm's environment to exploit opportunities and/or neutralise threats. For example, BHP Billiton's operational facilities explore the application of innovative technology to improve energy efficiency, low carbon alternative technologies and renewable energy technologies, in order to address climate change and related carbon emissions. Energy efficiency and low emission technologies provide significant opportunities to reduce the operating costs globally, and decrease liability for emissions in Europe and Australia (CDP Australia and New Zealand Report, 2012, p. 42).

Second, resource rareness relates to the perceived scarcity of the resource within markets. The rarity of such resources also enhances the reputation and legitimacy of the firms. If a particularly valuable resource is not possessed by many firms, this kind of resource has the potential to generate a competitive advantage (Barney, 1991). CMS adoption via the design of new product, process or technology can provide a firm with a rare capability and therefore contribute to a competitive advantage.

Third, CMS adoption through continuous improvement to processes is considered an inimitable resource because such a program can be both ambiguous and socially complex. Most successful continuous improvement processes incorporate multiple levels of engagement, from upper management to employees, and can even extend through the supply chain. For a company seeking to imitate such a process, the social relationships, deployment of human resources and strategy in selecting projects is not externally visible, which can make this type of resource difficult to imitate. In addition, a firm's reputation among customers and suppliers often falls into the category of social

complexity, which is beyond the ability of other firms to systematically imitate (Barney, 1991). It is considered that innovative companies such as these are at the vanguard of the drive for climate change mitigation and adaptation. They are often prepared to diversify from tried and tested products and services in response to evolving climate change regulation and consumer behaviour; thus, driving forward the market for sustainable goods and services.

Lastly, CMS adoption often requires the development of dynamic capabilities to mitigate carbon emissions. This aligns with the fact that many firms generate relevant capabilities from innovative products, improving existing processes, and investing in energy-efficient projects and green supply chain management. Specifically, the adoption of CMS provides management with the ability to consolidate collective learning on environmental issues into unique organisational capabilities and adapt quickly to changing opportunities. From the competitor's perspective, such capability is then often difficult to substitute.

In the context of Australian companies, there is an increasing appetite to act on climate change, with their approach towards carbon emissions management steadily developing (CDP Australia and New Zealand Report, 2015, p. 12). Despite the Australian Government scrapping its carbon pricing mechanism, around one-quarter of companies use an internally determined price per ton of carbon to guide their investment decisions (CDP Australia and New Zealand Report, 2015, p. 11). Furthermore, since 2010 there has been a jump of at least 20% in the amount of ASX 200 firms using incentives to drive climate change management, including setting intensity-based emissions reduction targets, and seeking external verification for their Scope 1 emissions data (CDP Australia and New Zealand Report, 2015, p. 12). Further, Scope 2 emissions of the companies that disclosed to CDP in both 2010 and 2012 had declined by 18%, suggesting reductions in the amount of power they used and/or its carbon intensity. Indeed, energy-efficiency projects are consistently the most popular approach to emissions reductions in Australia.

On the whole, the conclusion derived from these Phase 1 findings is that CMS adoption can be treated as a valuable, rare, non-substitutable and inimitable strategic resource. Companies that adopt CMS are more likely to develop unique organisational capabilities which can help them to gain a sustainable competitive advantage.

## 5.5 CHAPTER SUMMARY

This chapter presents the findings from Phase 1 of this study, to better understand the different types of CMS adopted by Australia's top 200 ASX-listed firms between 2008 and 2012. The results show that more than half of these firms adopted CMS; there is an increasing trend in the number of firms adopting CMS over the five-year period. This study also identified three types of CMS: (1) compensation strategy; (2) reduction strategy; and (3) all-rounder strategy. The discussion of different types of CMS is then extended to examine CMS adoption through the lens of RBV in terms of its four classic indicators: (1) valuable; (2) rare; (3) imperfectly imitable; and (4) non-substitutable.

The next three chapters present and examine the Phase 2 results using the empirical methods proposed in Chapter 4. Specifically, Chapter 6 is devoted to the results on the internal factors driving CMS adoption (i.e. RQ2); Chapter 7 then discusses the results of the relationship between stakeholder pressure and different types of CMS adopted (i.e. RQ3); and Chapter 8 contains the results of the association between CMS adoption and firm performance (i.e. RQ4).

# CHAPTER 6

# INTERNAL DRIVERS OF CMS ADOPTION: EMPIRICAL RESULTS

## 6.1 INTRODUCTION

In Chapter 5, the findings from Phase 1 of this study were discussed. These results led to the conclusion that CMS adoption should be treated as a strategic resource as it is valuable, rare, non-substitutable and inimitable. This chapter presents the empirical results of Phase 2(a) related to RQ2: Do internal organisational factors drive companies to adopt CMS in order to maintain legitimacy? The chapter is organised as follows: Section 6.2 presents the descriptive statistics of the variables. Then in Section 6.3, a correlation matrix is used to analyse the relationships between the relevant variables in relation to the internal drivers of CMS adoption. Section 6.4 presents the empirical results of the logit estimations of Equation (1). Section 6.5 then provides the robustness tests of the results for RQ2. In particular, these findings are tested for alternative measures of proxies for CMS adoption and control variables using two different estimation techniques: random effect; and industry effect. Section 6.6 discusses the findings from the four hypotheses tested and finally, Section 6.7 summarises the findings.

## 6.2 DESCRIPTIVE STATISTICS

Table 6.1 presents the descriptive statistics (i.e., means, medians, standard deviations, first-quartile and third-quartile) for the full sample. Panel A contains the nominal variables, and Panel B lists the continuous variables. As shown in Panel A, of the 894 firm-year observations included in this study across the five-year period, a total of 607 ASX 200 firms (67.90%) had adopted CMS. Panel A also shows that less than half of these firm-year observations (37.92%) had an EMS in place. With regard to environmental committees (ECOM), Panel A results reveal that only 23.94% (214 firm-year observations) had an ECOM. Despite these lower environmental proactivity results, a

total of 550 firm-year observations (61.52%) – more than half – belonged to an environmentally-sensitive industry (INDY).

Panel B shows that board size (BSIZE) across this study's firm-year observations had an inter-quartile range of 6 to 8 board members; the mean average BSIZE was 7.353 with a standard deviation of 2.020. This is similar to Kiel and Nicholson's (2006) study that reported the average board size for ASX 200 firms as 7.5. Board independence (BIND) had a Q1 (Q3) of 0.571 (0.833), and a mean (standard deviation) of 0.698 (0.160). The firms in this study considerably varied in terms of age, size and leverage. The average firm age (FAGE) was 18 years, with a standard deviation of 6 years. This is consistent with Wang and Oliver (2009) who reported that mean firm age as 16.90 for ASX 200 firms. The natural log of sample firm's revenue (FSIZE) had an inter-quartile range of 19.326 to 21.851, with a mean (standard deviation) of 20.399 (2.404). On average, the firms were levered with a mean (standard deviation) debt-to-assets ratio (LEV) of 0.247 (0.190).

**Table 6.1: Descriptive statistics**

| **Panel A: Nominal variables** | | |
|---|---|---|
| **Variables** | **Frequency (n=)** | **Percent** |
| ***CMS*** | | |
| Without CMS | 287 | 32.10 |
| With CMS | 607 | 67.90 |
| **Total** | **894** | **100** |
| ***EMS*** | | |
| Without EMS | 555 | 62.08 |
| With EMS | 339 | 37.92 |
| **Total** | **894** | **100** |
| ***ECOM*** | | |
| Without an ECOM | 680 | 76.06 |
| With an ECOM | 214 | 23.94 |
| **Total** | **894** | **100** |
| ***INDY*** | | |
| Not environmentally-sensitive INDY | 344 | 38.48 |
| Environmentally-sensitive INDY | 550 | 61.52 |
| **Total** | **894** | **100** |

| **Panel B: Continuous variables** | | | | | |
|---|---|---|---|---|---|
| **Variables** | **Mean** | **Median** | **Std. Dev.** | **Q1** | **Q3** |
| *BSIZE* | 7.353 | 7 | 2.020 | 6 | 8 |
| *BIND* | 0.698 | 0.714 | 0.160 | 0.571 | 0.833 |
| *FAGE* | 18 | 13 | 6 | 7 | 23 |
| *FSIZE* | 20.399 | 20.597 | 2.404 | 19.326 | 21.851 |
| *LEV* | 0.247 | 0.227 | 0.190 | 0.109 | 0.342 |

CMS = carbon management strategy is a dichotomous variable that equals 1 if a firm adopts CMS, and otherwise 0; EMS = environmental management system is a dichotomous variable that equals 1 if a firm implements an EMS, and otherwise 0; ECOM = environmental committee is a dichotomous variable that equals 1 if a firm has an environmental committee, and otherwise 0; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0; BSIZE = board size is the number of directors on the board; BIND = board independence is the number of independent directors scaled by the size of the board; FAGE = firm age is the number of years since the firm's incorporation; FSIZE = firm size is the natural logarithm of the firm's revenue; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year.

## 6.3 CORRELATION MATRIX AND BIVARIATE ANALYSIS

Table 6.2 presents the parametric Pearson's product moment correlation (see the bottom left side of the table) and non-parametric Spearman's rank correlation (see the top right side of the table). As shown in these results in relation to this study's firm-year

observations between 2008 and 2012, the significance levels shown in non-parametric measures coincide with that of the Pearson's correlation test. The panel data correlation results also show that CMS adoption among these firms had a significant positive relation with environmental management system (EMS), environmental committee (ECOM), board size (BSIZE) and board independence (BIND) at the 1% significance level. In addition, CMS adoption was positively correlated with the control variables including firm age (FAGE), firm size (FSIZE) and leverage (LEV), and negatively correlated with industry (INDY) at the same significance level of 1%. Among the independent variables, a number of strongly significant correlations can also be seen in Table 6.2. For example, EMS was positively related to ECOM, BSIZE and BIND at the 1% significance level. Furthermore, ECOM had a significant positive relation with BSIZE and BIND at the same significance level of 1%. The correlation between BSIZE and BIND was positive at the 1% significance level.

As shown in Table 6.2, among the observed firms' characteristics, firm age (FAGE) had a significant positive relation with firm size (FSIZE) and industry (INDY), while a significant negative relation was observed between FAGE and leverage (LEV). Firm size (FSIZE) was positively correlated with leverage (LEV), and inversely related to industry (INDY). Furthermore, LEV and INDY had a significant negative association. There was no indication of an unacceptable level of multicollinearity because the highest correlation coefficient between predictor variables was 0.495 and 0.564 for Pearson and Spearman, respectively. A number of statistics experts (e.g. Tabachnick & Fidell, 2001) have agreed that a harmful level of multicollinearity is not present until the correlation coefficient reaches around 0.80. This study also analysed the variance-inflation factors (VIF) and tolerance of explanatory variables among the firm-year observations. The average VIF of 1.38 and the maximum VIF of 1.53 (with FSIZE) were below 2. These diagnostics confirmed that multicollinearity was not a cause for concern.

**Table 6.2: Correlation matrix**

| Variables | CMS | EMS | ECOM | BSIZE | BIND | FAGE | FSIZE | LEV | INDY |
|---|---|---|---|---|---|---|---|---|---|
| **CMS** | 1 | 0.244*** | 0.234*** | 0.313*** | 0.285*** | 0.131*** | 0.383*** | 0.181*** | -0.104*** |
| **EMS** | 0.244*** | 1 | 0.220*** | 0.104*** | 0.205*** | 0.163*** | 0.200*** | 0.058* | 0.278*** |
| **ECOM** | 0.234*** | 0.220*** | 1 | 0.215*** | 0.325*** | 0.199*** | 0.262*** | -0.037 | 0.146*** |
| **BSIZE** | 0.300*** | 0.090*** | 0.201*** | 1 | 0.224*** | 0.252*** | 0.564*** | 0.150*** | -0.109*** |
| **BIND** | 0.265*** | 0.206*** | 0.312*** | 0.144*** | 1 | 0.202*** | 0.391*** | 0.002 | -0.095*** |
| **FAGE** | 0.139*** | 0.169*** | 0.219*** | 0.274*** | 0.203*** | 1 | 0.282*** | -0.073** | 0.055* |
| **FSIZE** | 0.349*** | 0.162*** | 0.215*** | 0.495*** | 0.329*** | 0.266*** | 1 | 0.129*** | -0.090*** |
| **LEV** | 0.173*** | 0.045* | -0.069** | 0.143*** | -0.065* | -0.086*** | 0.129*** | 1 | -0.161*** |
| **INDY** | -0.104*** | 0.278*** | 0.146*** | -0.101*** | -0.077** | 0.065** | -0.090*** | -0.161*** | 1 |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.
## Pearson product moment correlation is in the bottom left matrix, while Spearman's rank correlation is in the top right matrix.

CMS = carbon management strategy is a dichotomous variable that equals 1 if a firm adopts CMS, and otherwise 0; EMS = environmental management system is a dichotomous variable that equals 1 if a firm implements an EMS, and otherwise 0; ECOM = environmental committee is a dichotomous variable that equals 1 if a firm has an environmental committee, and otherwise 0; BSIZE = board size is the number of directors on board; BIND = board independence is the number of independent directors scaled by the size of the board; FAGE = firm age is the number of years since the firm's incorporation; FSIZE = firm size is the natural logarithm of the firm's revenue; LEV = leverage is the ratio of total debt to total assets at the end of fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

## 6.4 MULTIVARIATE ANALYSIS

This section reports the multivariate regression results related to RQ2 in this study. More specifically, Table 6.3 shows whether CMS adoption among the ASX 200 sample firms was positively related to the EMS (H1A), environmental committee (H1B), board size (H1C) and board independence (H1D). This model presents logistic regression estimates of Equation (1), with Huber (1964) or White (1980) standard errors robust to heteroskedasticity in the residuals. Furthermore, the firm clustering technique was applied for all the analyses because multiple observations from the same firm (but from different years) were included in the dataset. The time dummies were also used to address the cross-sectional dependence in the errors (if any).

**Table 6.3: Logistic regression results – internal drivers of CMS adoption**

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* | *Odds ratio* |
|---|---|---|---|---|---|
| Dependent variable: | CMS | | | | |
| Constant: | C | | -5.406 | **0.001*** ** | 0.004 |
| Independent variables: | EMS | + | 1.157 | **0.001*** ** | 3.180 |
| | ECOM | + | 1.104 | **0.013** ** | 3.017 |
| | BSIZE | + | 0.226 | **0.010** ** | 1.254 |
| | BIND | + | 1.927 | **0.028** ** | 6.874 |
| Control variables: | FAGE | + | -0.024 | 0.896 | 0.975 |
| | FSIZE | + | 0.158 | **0.029** ** | 1.171 |
| | LEV | + | 1.779 | **0.008*** ** | 5.925 |
| | INDY | + | -0.613 | **0.049** ** | 0.541 |
| Year dummy variables: | | | Included | | |
| *Pseudo* $R^2$= 0.2314 | *Wald Chi-square= 87.20 (0.001)* | | Correctly classified =79.31% | | *Total observation =894* |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMS = carbon management strategy is a dichotomous variable that equals 1 if a firm adopts CMS, and otherwise 0; EMS = environmental management system is a dichotomous variable that equals 1 if a firm implements an EMS, and otherwise 0; ECOM = environmental committee is a dichotomous variable that equals 1 if a firm has an environmental committee, and otherwise 0; BSIZE = board size is the number of directors on board; BIND = board independence is the number of independent directors scaled by the size of the board; FAGE = firm age is the number of years since the firm's incorporation; FSIZE = firm size is the natural logarithm of the firm's revenue; LEV = leverage is the ratio of total debt to total assets at the end of fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

Goodness-of-fit tests were also conducted to determine if the model significantly predicted the likelihood of the hypothesised relationships. These tests showed that the Wald Chi-square value of 87.20 was significant at the 1% level, suggesting that Model 1 distinguished the study's ASX 200 firms that adopted CMS from those that did not. The

model correctly classified 79.31% of the cases. Furthermore, Pseudo R-squared value showed that the model explained 23.14% of the variation in the CMS adoption status of the sample firms. The odds ratios for the binary logistic results are also presented in Table 6.3. An odds ratio is the increase (or decrease if the ratio is less than 1) in odds of being in one outcome category when the value of the predictor increases by one unit (Tabachnick & Fidell, 2001). It is worth noting that the odds ratios for all the hypothesised predictor variables were more than 1.

Model 1 examined the association between implementing an EMS and CMS adoption among the sample firms. It found a positive significant coefficient ($\beta$ = 1.157, p = 0.001) for EMS. These results also indicate that the firms were more likely to adopt CMS when they had voluntarily implemented EMS; thus supporting H1A. Furthermore, the odds ratios for EMS in Model 1 imply that those firms with EMS were 3.180 times more likely to adopt CMS compared with those firms without EMS.

Similarly, the analysis showed a positive significant coefficient ($\beta$= 1.104, p = 0.013) for environmental committee (ECOM), which suggests an association between the existence of corporate environment committees and CMS adoption. This supports H1B. These results also add credence to the study by Liao et al. (2015) which found that environmental committees have a positive effect on carbon strategy development. Furthermore, the odds ratio for ECOM indicates that the odds of CMS adoption in firms with environmental committees were 3.017 times higher compared with those without such a committee.

The analyses also identified a positive significant coefficient ($\beta$ = 0.226, p =0.010) for board size (BSIZE). This implies that the observed firms were more likely to adopt CMS when they had a larger board thereby supporting H1C. In addition, the odds ratio for BSIZE implies that the odds of CMS adoption increase by 1.254 times when the number of board size increases by one unit. Furthermore, the study has documented a positive significant coefficient ($\beta$ = 1.927, p = 0.028) for board independence (BIND), which confirms that the greater the board independence, the more likely these observed firms were to adopt CMS. These findings render support for H1D, and also add credibility to the study by Liao et al. (2015) which found that the percentage of independent directors on the board is positively associated with the tendency to disclose GHG information. In

addition, the odds ratio for BIND suggests that the likelihood of CMS adoption increased by 6.874 times when the number of independent directors in the observed firms' board increased by one unit.

With regard to the control variables used in Model 1, firm size was found to be positively associated with CMS adoption among the observed firms. One corresponding argument is that large companies generally attract the attention of diverse stakeholders, who use intense pressure and scrutiny to force them to engage in social and environmental activities as a way of maintaining their legitimacy within their operating environment (Stanny & Ely, 2008). In line with this, the estimated coefficient for leverage in Model 1 was significantly positive, suggesting that the highly-leveraged firms were more likely to adopt CMS. Prior studies (Clarkson et al., 2008; Liao et al., 2015) have suggested that debtholders in particular exercise pressure on firms to disclose environmental-related matters to assess potential future liabilities. Therefore, it can be speculated in this study that highly leveraged firms are more inclined to adopt CMS in expectation of having to disclose higher levels of GHG information.

Contrary to the expectation, the negative sign of the coefficient for industry (INDY) suggested that those observed firms in environmentally-sensitive industries had a lower propensity to adopt CMS. This result is consistent with some of the prior studies on climate change disclosure practices. For example, Stanny and Ely (2008) found that firms in high-carbon industries (e.g. utilities, energy, materials and industries) are less likely to disclose information about climate change. In line with this, a recent study by Tauringana and Chithambo (2015) suggested that firms in heavily-polluting industries feel that greater disclosure exposes their own companies even more; as a result, they are less likely to disclose their emissions. In contrast, less environmentally-risky industries are more likely to disclose as a way of pre-empting potential regulation that might be costly to comply with. Furthermore, Elijido-Ten (2011a) confirmed that non-environmentally-sensitive industries are more likely to provide sustainability reports and balanced scorecards disclosures compared with those firms belonging to environmentally-sensitive industries. The current study investigates this further. It introduced an interaction variable into Model 1 to capture the interaction effect between industry and firm size variables. The results that are presented in Table A.1 in Appendix A show a positive and significant coefficient for the interaction variable, indicating that those larger observed firms in

environmentally-sensitive industries were more likely to adopt CMS. Rankin et al. (2011) found that firms in environmentally-sensitive industries (e.g. energy, mining and industrial) are more inclined to report credible GHG emissions information, as they are exposed to greater regulatory and market risks. Furthermore, Hrasky (2012) revealed that firms in carbon-intensive industry sectors often respond differently from those in less carbon-intensive sectors. That is, disclosures by firms in carbon-intensive sectors appear to be shifting more towards a moral legitimation strategy by adopting CMS aimed at reducing their carbon footprint.

## 6.5 FURTHER ANALYSES

This section discusses the additional analyses that were conducted to check the robustness of the overall Phase 2(a) results as outlined above in Section 6.4. The relevant results have been tabulated in Appendix A.

### 6.5.1 Alternative measure of CMS adoption

To check the robustness of model 1 in Table 6.3, this study used the following alternative definitions of CMS adoption across the observed firm-years, based on ordered categorical variables: 0 if a company did not adopt any CMS; 1 if it adopted compensation strategy; 2 if it adopted reduction strategy; and 3 if it adopted all-rounder strategy. The ordered probit model was estimated to assess the internal organisational factors driving the adoption of various CMSs. The corresponding CMS adoption criteria were as previously described in Chapter 4 in Section 4.3.2. The perceived importance of each internal factor was then measured by marginal effects. Marginal effects and corresponding p - values are presented in Table A.2 of Appendix A. As shown in outcome 1 (in Table A.2), the marginal effects of internal drivers like environmental management system (EMS), environmental committee (ECOM), board size (BSIZE) and board independence (BIND) were insignificant for compensation strategy. Thus, this study makes no inference regarding the internal drivers of compensation strategy adoption. However, in outcomes 2 and 3, the marginal effects of EMS, ECOM, BSIZE and BIND were positive and significant. These results imply that firms which adopt reduction and all-rounder strategy are more likely to have an EMS, an environmental committee, larger board size and greater board independence. The results therefore confirm the findings from the original model, although the pseudo R-squared slightly decreased when this alternative measure of CMS adoption was used.

### 6.5.2 Random effect

This study utilised a random effect model as an alternative estimation technique. Such a model is used to address the possibility of any spurious relationships between the dependent and independent variables, which may arise due to the exclusion of unmeasured explanatory variables. Table A.3 in Appendix A shows the results of the random effect modelling used in this study. Consistent with the main findings (shown in Table 6.3), EMS, ECOM and BIND continued to show significant results and remained at the same significance level. The only change was the coefficient for BSIZE, which instead showed an expected positive sign but was still insignificant.

### 6.5.3 Industry effect

In this study, the GICS was also used to control for industry differences instead of a dummy variable for environmentally-sensitive versus non-environmentally-sensitive across the observed firm-years. Ten GICS industries were identified: consumer discretionary (COND); consumer staples (CONS); energy (ENG); financials (FIN); health care (HCR); industrials (INDS); information technology (IT); material (MAT); telecommunication services (TCS); and utilities (UTL). The corresponding results are presented in Table A.4 in Appendix A.

Within these results, EMS, ECOM, BSIZE and BIND continued to show significance, with ECOM more significant (at $p<.01$ compared to $p<.05$) while the others remained at the same significance level. This was most consistent with the main findings shown in Table 6.3. In regards to industry dummy variables, the HCR, INDS and MAT variables were significant. Furthermore, the negative coefficients confirmed that those firms in environmentally-sensitive industries were less inclined to adopt CMS, which also aligned with the main results.

### 6.5.4 Alternative measure of control variable

This study also performed further analysis to check the robustness of the results relating to internal drivers of CMS adoption among the sample firms. Two alternative measures of firm size were used as control variables, with the corresponding results presented in Table A.5 in Appendix A. In model 1, the natural logarithm of each firm's total assets was used as a proxy of firm size, while in model 2 a natural logarithm of each firm's market capitalisation was used as a measure of firm size. In both models, EMS,

ECOM and BIND continued to show significant results, with EMS and ECOM remaining at the same significance level. However, BIND became less significant (at $p<.10$ compared to $p<.05$) in model 1, while it became more significant (at $p<.01$ compared to $p<.05$) in model 2.

The only other change was the coefficient for BSIZE now showed the expected positive sign, although it was still insignificant in both models. Excluding BSIZE, the findings in the original logit model in Table 6.3 proved to be robust irrespective of whether alternative measures of firm size as control variables were used.

## 6.6 DISCUSSION OF PHASE 2(a) FINDINGS

This part of the study has set out to investigate whether internal organisational factors such as the presence of an EMS, having an environmental committee, larger board and greater board independence drive CMS adoption to maintain legitimacy. It has often been recognised that internal organisational factors assist companies to credibly monitor, measure and record emissions levels to reduce risks linked to future regulatory requirements and changing societal expectations (Rankin et al., 2011).

In testing H1A in this study, it is determined that there is a predominantly significant positive relationship between the presence of an EMS and CMS adoption. EMS is intended to design and enhance operations, processes and products to prevent negative environmental impacts. Having an EMS is therefore considered a proactive environmental practice (Darnall et al., 2008) which has been shown to lead to improved environmental performance (King et al., 2005). Given the support this study has found for H1A, it can therefore be speculated that firms experienced in adopting EMS are more inclined to adopt CMS. Arguably, most firms would expect that the adoption of CMS will result in increased internal efficiency and external legitimacy in relation to carbon performance.

Similarly, given that environmental committees are endowed with the responsibility to instigate proactive environmental strategies (Ashforth & Gibbs, 1990), it is evident in this study (as confirmed in the results showing support for H1B) that the presence of such committees will increase the likelihood of CMS adoption to ensure the occurrence of legitimacy gaps is avoided. Environmental committees are responsible for

managing firms' environmental risks, which include environmentally-related reputational risk and threats to legitimacy. The existence of an environmental committee also indicates how proactive a firm is in relation to addressing environmental issues (Liao et al., 2015). Thus, it is conceivable that an environmental committee that is driven by legitimacy and reputation management motives would influence a firm to adopt a CMS that attempts to mitigate carbon emissions.

The study also found evidence that firms with larger boards and a higher concentration of independent directors in a board (providing support for H1C and H1D) have a higher propensity to adopt CMS. The quality of corporate governance often relates to the decision to disclose GHG information (Rankin et al., 2011). Thus, Tauringana and Chithambo (2015) suggested that board size affects the extent of GHG information disclosure – larger boards tend to have more diverse skills and experience, allowing greater oversight (Dalton, Daily, Johnson & Ellstrand, 1999). In line with this, the results confirm that firms with a larger number of board members have stronger inclination to deal with issues relating to carbon emissions by adopting CMS to improve corporate image, avoid potential damage to the firm's reputation and thereby maintain legitimacy. Likewise, board independence is vital in addressing climate change issues because it enables the injection of new insights and perspectives related to environmental and social stakeholders (Galbreath, 2010). Therefore, firms with more independent directors are more likely to divert resources towards the adoption of CMS to legitimise organisational operations and to demonstrate that their activities are congruent with societal expectations. This study's corresponding results in relation to board size and level of independence are consistent with the generalised idea of independent and diversified boards as a 'best practice' for climate change outcomes (Liao et al., 2015).

Drawing from the complementary perspective of legitimacy theory and RBV, the Phase 2(a) results also confirm that CMS adoption, in conjunction with better governance mechanism and voluntary EMS implementation, is an ideal way that firms can show their commitment to environmental sustainability and climate change mitigation in order to maintain corporate legitimacy. A legitimation response is often necessary because various stakeholders demand a new implicit clause to the social contract – a clause that addresses new societal expectation about how corporate carbon footprints are managed. Hence, to keep the social contract intact and to maintain legitimacy, firms need to convince the

society in which they operate that they are responding to their concerns about carbon emissions. In so doing, firms undertake a broader spectrum of activities to mitigate carbon emissions. Hence, CMS adoption through the design of new products, processes and innovative technologies could provide the firm with a rare capability. Furthermore, companies that adopt CMS are more likely to develop unique capabilities which help them to achieve a sustainable competitive advantage.

In addition, organisational legitimacy is a significant resource upon which the organisation depends for survival (Ogden & Clarke, 2005). It can lead to an enhanced strategic position and is often necessary for establishing sustainable competitive advantages (Lin et al., 2009). The need for legitimacy is often seen as a force that drives organisations to adopt socially acceptable practices and goals (Meyer & Rowan, 1977). Many firms that recognise the importance of achieving organisational legitimacy have proactively managed environmental issues by way of adopting CMS, and hence develop organisational capability to gain a competitive advantage.

## 6.7 CHAPTER SUMMARY

This chapter has presented the empirical results for the hypotheses H1A, H1B, H1C and H1D. With regard to hypothesis H1A, a positive relationship was found between those observed firms with established EMS and CMS adoption. Furthermore, those firms with an environmental committee as part of the board structure were more likely to have adopted CMS. Likewise, those firms with a larger board were more likely to mitigate carbon emissions by adopting CMS. In addition, with regard to hypothesis H1D in relation to board independence, it was found in this study that those boards with a large number of independent directors were more likely to adopt CMS. The summary of these results are presented in Table 6.4.

These findings suggest that the main internal drivers for CMS adoption are the existence of an EMS, environmental committee, larger board and greater board independence. The next Chapter 7 presents the findings from this study's RQ3 examining whether various stakeholder pressures (regulatory, primary and secondary) are related to different types of CMS adoption corresponding to hypotheses H2A, H2B and H2C.

**Table 6.4: Summary of results of testing relevant hypotheses**

**H1A, H1B, H1C and H1D**

| Hypotheses | Testing procedure | Dependent variable | Results | Supported/ not supported |
|---|---|---|---|---|
| H1A: Firms that have voluntarily established an EMS are more likely to adopt CMS than those firms without an EMS. | The coefficient of EMS variable (β1) in Equation (1) was estimated using logistic regression and was expected to be statistically significant. | CMS adoption | The coefficient of EMS (β1) was positive and significant at the 1% level. | Supported |
| Further analysis: | i) Alternative measure of CMS adoption<br>ii) Random effect<br>iii) Industry effect<br>iv) Alternative measure of control variable | | The coefficient or marginal effect of EMS was positive and significant. | Supported |
| H1B: Firms with an environmental committee are more likely to adopt CMS than those firms without such a committee. | The coefficient of ECOM variable (β2) in Equation (1) was estimated using logistic regression and was expected to be statistically significant. | CMS adoption | The coefficient of ECOM (β2) was positive and significant at the 5% level. | Supported |
| Further analysis: | i) Alternative measure of CMS adoption<br>ii) Random effect<br>iii) Industry effect<br>iv) Alternative measure of control variable | | The coefficient or marginal effect of ECOM was positive and significant. | Supported |
| H1C: The higher the number of board members, the greater the likelihood of the firm adopting CMS. | The coefficient of BSIZE variable (β3) in Equation (1) was estimated using logistic regression and was expected to be statistically significant. | CMS adoption | The coefficient of BSIZE (β3) is positive and significant at the 5% level. | Supported |
| Further analysis: | i) Alternative measure of CMS adoption<br>iii) Industry effect | | The coefficient or marginal effect of BSIZE was positive and significant. | Supported |
| | ii) Random effect<br>iv)Alternative measure of control variable | | The coefficient of BSIZE was positive but insignificant. | Not Supported |
| H1D: The higher the number of independent board members, the greater the likelihood of the firm adopting CMS. | The coefficient of BIND variable (β4) in Equation (1) was estimated using logistic regression and was expected to be statistically significant. | CMS Adoption | The coefficient of BIND (β4) was positive and significant at the 5% level. | Supported |
| Further analysis: | i) Alternative measure of CMS adoption<br>ii) Random effect<br>iii) Industry effect<br>iv) Alternative measure of control variable | | The coefficient or marginal effect of BIND was positive and significant. | Supported |

# CHAPTER 7

# STAKEHOLDER PRESSURE AND CMS ADOPTION: EMPIRICAL RESULTS

## 7.1 INTRODUCTION

In Chapter 6, the findings from Phase 2(a) of this study were discussed. This chapter provides the results of Phase 2(b) related to RQ3: Do companies' likelihood of adopting a given CMS depend on the pressure from certain groups of stakeholder? The remainder of this chapter is structured into the following six sections. Section 7.2 presents the descriptive statistics of the variables, while Section 7.3 relates to the correlation matrix used to identify potential relationships based on the hypotheses in relation to RQ3. Section 7.4 then presents the empirical results of the ordered probit estimations of Equation (2). The next Section 7.5 provides the robustness tests (further analysis) of the results for RQ3. In particular, the findings are tested for alternative measures of proxies (CMS adoption, industry dummy and control variables) and with the different estimation technique (random effect). Section 7.6 then presents an overall discussion of the findings of the three hypotheses (H2A, H2B and H2C) tested, followed by the chapter summary in Section 7.7.

## 7.2 DESCRIPTIVE STATISTICS

Table 7.1 presents the descriptive statistics (i.e., means, medians, standard deviations, first-quartile and third-quartile) for the full sample. In this table, Panel A contains the nominal variables and Panel B the continuous variables. Among the 850 firm-year observations in this study between 2008 and 2012, about one-third (278 or 32.71%) did not adopt any CMS. Among those that did adopt a CMS, only 10 adopted compensation strategy and 67 an all-rounder strategy. Reduction strategy was clearly the most dominant CMS adoption category (495 or 58.24%). Panel A also shows that less than half of the firm-year observations (325 or 38.24%) were required to disclose carbon emissions data under the *NGER Act 2007*. Furthermore, most (761 or 89.53%) had not

encountered any publicity that portrayed their environmental practices in a negative way. On the other hand, more than half of the firm-year observations (520 or 61.18%) belonged to an environmentally-sensitive industry (INDY).

Panel B shows that the employee (EMP) measure in relation to the firm-year observations had an inter-quartile range of 6.469 to 9.061, with a mean (standard deviation) of 7.702(1.848). Institutional investor (INS) had a mean of 67.714, and a standard deviation of 14.735, while the average of media (MDA) was 5.661. The results also show that the firms varied considerably in terms of size and leverage. The natural log of the sample firm's total assets (FSIZE) had an inter-quartile range of 20.266 to 22.490, with a mean (standard deviation) of 21.429 (1.836). On average, the firms were levered with a mean (standard deviation) debt-to-assets ratio (LEV) of 0.240 (0.196).

## Table 7.1: Descriptive statistics

| **Panel A: Nominal variables** | | | | | |
|---|---|---|---|---|---|
| **Variables** | **Frequency (n=)** | | **Percent** | | |
| ***CMST*** | | | | | |
| Without CMS | 278 | | 32.71 | | |
| No of firms which adopt Compensation strategy | 10 | | 1.18 | | |
| No of firms which adopt Reduction strategy | 495 | | 58.24 | | |
| No of firms which adopt All-rounder strategy | 67 | | 7.87 | | |
| **Total** | **850** | | **100** | | |
| ***REG*** | | | | | |
| Do not report under *NGER Act 2007* | 525 | | 61.76 | | |
| Report under *NGER Act 2007* | 325 | | 38.24 | | |
| **Total** | **850** | | **100** | | |
| ***ENGO*** | | | | | |
| Without negative publicity | 761 | | 89.53 | | |
| With negative publicity | 89 | | 10.47 | | |
| **Total** | **850** | | **100** | | |
| ***INDY*** | | | | | |
| Not environmentally-sensitive INDY | 330 | | 38.82 | | |
| Environmentally-sensitive INDY | 520 | | 61.18 | | |
| **Total** | **850** | | **100** | | |
| **Panel B: Continuous variables** | | | | | |
| **Variables** | **Mean** | **Median** | **Std. Dev.** | **Q1** | **Q3** |
| *EMP* | 7.702 | 7.824 | 1.848 | 6.469 | 9.061 |
| *INS* | 67.714 | 69.445 | 14.735 | 57.301 | 79.434 |
| *MDA* | 5.661 | 1 | 6.619 | 0 | 4 |
| *FSIZE* | 21.429 | 21.394 | 1.836 | 20.266 | 22.490 |
| *LEV* | 0.240 | 0.216 | 0.196 | 0.083 | 0.335 |

CMST = carbon management strategy type is an ordered categorical variable that equals 0 if a company does not adopt any CMS, 1 if a company adopts compensation strategy, 2 if it adopts reduction strategy, and 3 if it adopts all-rounder strategy; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; ENGO = environmental non-government organisation is a binary variable that equals 1 if any publicity portrays the company's environmental practices in a negative light, and otherwise 0; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0; EMP = employee is the natural logarithm of the number of employees in a company; INS = institutional investor is the percentage of shares owned by institutional investors in a particular company; MDA = media is the total number of articles that include a statement about the company and its environmental issues; FSIZE = firm size is the natural logarithm of the firm's total assets; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year.

## 7.3 CORRELATION MATRIX AND BIVARIATE ANALYSIS

Table 7.2 reports both parametric Pearson's product moment (see the bottom left side of the table), and non-parametric Spearman rank correlation (see the top right side of the table) for all variables in relation to the firm-year observations. The Pearson correlation between compensation strategy adoption (COMP) and institutional investor (INS) which is used as a proxy of primary stakeholder pressure was negative and significant at the 10% level. In addition, COMP was negatively correlated with the proxies for secondary stakeholder: media (MDA) and environmental non-government organisation (ENGO) at the 1% significance level. Spearman rank correlations show similar associations between the above-mentioned variables. In regards to the control variables, COMP was negatively correlated with firm size (FSIZE) and leverage (LEV), while positively related to industry (INDY) at the 1% significance level, using both correlations.

Consistent with the expectation, both the Pearson and Spearman correlation coefficients for reduction strategy adoption (RED) and INS were positive and significant at the 1% level. The correlation between RED and the proxies for secondary stakeholder pressure also had the expected positive sign, and they were significant for MDA and ENGO based on both estimates. In terms of control variables, the Pearson correlation estimates report that RED was positively correlated with FSIZE and LEV, whereas negatively correlated with INDY at the 1% significance level. Spearman rank correlations show similar associations between the above-mentioned variables.

The correlation between all-rounder strategy adoption (ALL) and INS was positive and significant at the 10% level. Pearson correlation estimates also report that ALL was positively correlated with MDA and ENGO, and these correlations were statistically significant at the 1% level. Spearman rank correlations show similar associations between the above-mentioned variables. The correlations between ALL and each of the control variables were in the expected directions, and they were significant for FSIZE, LEV and INDY based on both estimates.

Furthermore, there is no indication that an unacceptable level of multicollinearity was present between independent variables in relation to the firm-year observations. Multicollinearity occurs when any independent variable is highly correlated with another

independent variable/s. When variables are multicollinear, redundant information could make the analysis misleading. A number of statistics experts (e.g. Hair, Anderson, Tatham & Black, 1998; Tabachnick & Fidell, 2001) have agreed that a harmful level of multicollinearity is not present until the correlation coefficient reaches around 0.80. Further tests for multicollinearity were conducted because the highest correlation coefficient was 0.762 and 0.741 for Pearson and Spearman, respectively. This study analysed the variance-inflation factors (VIF) and tolerance of explanatory variables. The average VIF was 1.39 and the maximum was 1.57. VIFs were each close to 1, and much less than the recommended maximum threshold of 10, indicating that multicollinearity between the variables is not a concern.

**Table 7.2: Correlation matrix**

| Variables | COMP | RED | ALL | REG | EMP | INS | MDA | ENGO | FSIZE | LEV | INDY |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **COMP** | 1 | -0.556*** | -0.622*** | 0.027 | -0.012 | -0.069* | -0.548*** | -0.487*** | -0.759*** | -0.235**** | 0.137*** |
| **RED** | -0.188*** | 1 | 0.755*** | -0.056* | 0.007 | 0.209*** | 0.315*** | 0.040* | 0.713*** | 0.413*** | -0.182*** |
| **ALL** | -0.696*** | 0.003 | 1 | -0.046 | 0.024 | 0.142*** | 0.596*** | 0.479*** | 0.741*** | 0.436*** | -0.212*** |
| **REG** | 0.012 | -0.050 | -0.013 | 1 | -0.053 | 0.041 | 0.016 | 0.007 | -0.020 | -0.060* | 0.035 |
| **EMP** | -0.017 | 0.003 | 0.044 | -0.058* | 1 | -0.029 | 0.028 | 0.009 | 0.023 | -0.005 | 0.016 |
| **INS** | -0.025* | 0.207*** | 0.005* | 0.039 | -0.014 | 1 | 0.024 | -0.050 | -0.006 | -0.036 | 0.004 |
| **MDA** | -0.575*** | 0.109*** | 0.706*** | 0.056 | 0.039 | -0.086** | 1 | 0.498*** | 0.539*** | 0.078** | -0.019 |
| **ENGO** | -0.671*** | 0.005* | 0.683*** | 0.007 | 0.007 | 0.042 | 0.534*** | 1 | 0.350*** | 0.041 | 0.091* |
| **FSIZE** | -0.762*** | 0.552*** | 0.754*** | -0.026 | 0.040 | -0.012 | 0.377*** | 0.354*** | 1 | 0.366*** | -0.303*** |
| **LEV** | -0.218*** | 0.354*** | 0.205*** | -0.063* | 0.001 | -0.040 | 0.014 | 0.030 | 0.278*** | 1 | -0.189*** |
| **INDY** | 0.115*** | -0.195*** | -0.114*** | 0.035 | 0.013 | 0.018 | 0.069 | 0.091*** | -0.326*** | -0.153*** | 1 |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

## Pearson product moment correlation is in the bottom left matrix while Spearman's rank correlation is in the top right matrix.

COMP = company which adopts compensation strategy; RED = company which adopts reduction strategy; ALL = company which adopts all-rounder strategy; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; EMP = employee is the natural logarithm of the number of employees in a company; INS = institutional investor is the percentage of shares owned by institutional investors in a particular company; MDA = media is the total number of articles that include a statement about the company and its environmental issues; ENGO = environmental non-government organisation is a binary variable that equals if any publicity portrays the company's environmental practices in a negative light, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's total assets; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

## 7.4 MULTIVARIATE ANALYSIS

This section discusses the results from testing H2A, H2B and H2C by estimating the regression Equation (2) as introduced in Section 4.4.2. The ordered probit model was used to assess if the likelihood of adopting a given CMS type is dependent on the pressure from certain groups of stakeholder. The dependent variable CMST is an ordered categorical variable representing compensation, reduction and all-rounder strategies. This aligns with ordinal logistic regression which takes into account inherent ordering of outcome levels (Kleinbaum & Klein, 2010). Table 7.3 presents the marginal effects for the ordered probit model and the corresponding p-values. The perceived pressure from each stakeholder group was measured by marginal effects.

Goodness-of-fit tests were also conducted to determine if the empirical model significantly predicted the likelihood of the hypothesised relationships examined in this study. The empirical model had a Chi-square value of 266.34 which was significant at the 1% level. The pseudo R-squared values also show that the model was able to explain 16.59% of the variability in CMS adoption among the firm-year observations. The explanatory power of the model is comparable with the study by Darnall et al. (2010) on the adoption of proactive environmental strategy and the influence of stakeholders. The reported results are heteroskedasticity and autocorrelation consistent as per both Huber's (1964) and White's (1980) robust standard errors.

Outcome 1 in Table 7.3 shows the relationship between pressure from regulatory (REG), primary (EMP and INS) and secondary (MDA and ENGO) stakeholders and compensation strategy adoption, while outcome 2 and 3 demonstrate the link of various stakeholder pressures to reduction and all-rounder strategies adoption respectively. The marginal effects capturing the perceived pressure from regulatory stakeholder (REG) was positive among those sample firms adopting compensation strategy (in outcome 1), and negative for firms with reduction and all-rounders strategies (in outcomes 2 and 3). However, the proxy for REG was insignificant across all outcomes; thus, H2A is not supported.

In regards to primary stakeholders, the two proxies in this study are EMP and INS. When examining this study's firm-year observations, the marginal effects for EMP were not significant for any type of CMS (in outcomes 1, 2 and 3). However, the marginal

effects of INS were positive at the significance level of $p < 0.05$, indicating that the firms that pursued reduction and all-rounder strategies (in outcomes 2 and 3) were more likely to receive pressure from institutional investors. In addition, the negative marginal effects of INS with $p < 0.1$ explained that those firms that pursued compensation strategy (in outcome 1) were less likely to perceive pressure from institutional investor. Thus, H2B is partially supported for INS but not for EMP.

These results are consistent with the study by Buysse and Verbeke's (2003), who concluded that primary stakeholders are perceived as most important by firms with proactive environmental strategy (i.e. environmental leadership strategy, pollution-prevention strategy) and least important among those with reactive environmental strategy (i.e. end-of-pipe). It is therefore conceivable that proactive CMS (i.e. reduction and all-rounder strategies) aims to minimise the carbon emissions via the design of new product, process and innovative technologies. In contrast, compensation strategy is reflective of a reactive posture, such as by increasing emissions limits by purchasing emissions allowances, which indicates that limited resources have been committed to mitigating carbon emissions to conform to legal requirements. The results imply that primary stakeholder pressure can play a vital role in encouraging firms to adopt reduction and all-rounder strategies.

**Table 7.3: Ordered probit regression results – stakeholder pressure and CMS adoption**

| | | **Outcome 1:** | | | **Outcome 2:** | | | **Outcome 3:** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Compensation strategy** | | | **Reduction strategy** | | | **All-rounder strategy** | | |
| | | **Expected sign** | **Marginal effects** | **Probability** | **Expected sign** | **Marginal effects** | **Probability** | **Expected sign** | **Marginal effects** | **Probability** |
| Dependent variable: | CMST | | | | | | | | | |
| Independent variables: | REG | + | 0.00021 | 0.567 | - | -0.00960 | 0.560 | - | -0.00592 | 0.560 |
| | EMP | - | -0.00002 | 0.979 | + | 0.00011 | 0.979 | + | 0.00006 | 0.979 |
| | INS | - | -0.00003 | **0.065*** | + | 0.00125 | **0.020**** | + | 0.00077 | **0.024**** |
| | MDA | - | -0.00003 | **0.076*** | + | 0.00139 | **0.034**** | + | 0.00086 | **0.026**** |
| | ENGO | - | -0.00233 | **0.021**** | + | 0.10693 | **0.001***** | + | 0.06595 | **0.001***** |
| Control variables: | FSIZE | - | -0.00123 | **0.003***** | + | 0.05663 | **0.001***** | + | 0.03493 | **0.001***** |
| | LEV | - | -0.00234 | **0.051*** | + | 0.10744 | **0.011**** | + | 0.06626 | **0.014**** |
| | INDY | +/- | -0.00024 | 0.547 | + | 0.01097 | 0.539 | + | 0.00676 | 0.540 |
| Year dummy variables: | | | Included | | | Included | | | Included | |
| | | *Pseudo $R^2$ = 0.1659* | | | *Chi-square = 266.34 (0.001)* | | | *Total observation = 850* | | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMST = carbon management strategy type is an ordered categorical variable that equals 0 if a company does not adopt any CMS, equals 1 if a company adopts compensation strategy, equals 2 if it adopts reduction strategy, and equals 3 if it adopts all-rounder strategy; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; EMP = employee is the natural logarithm of the number of employees in a company; INS = institutional investor is the percentage of shares owned by institutional investors in a particular company; MDA = media is the total number of articles that include a statement about the company and its environmental issues; ENGO = environmental non-government organisation is a binary variable that equals 1 if any article portrays the company's environmental practices in a negative light, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's total assets; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

MDA and ENGO were the two proxies of secondary stakeholder pressure used in this study. In relation to the firm-year observations, the positive marginal effect of MDA was significant at $p < 0.05$ for firms adopting reduction strategy and all-rounder strategy (in outcomes 2 and 3). Furthermore, there were negative significant marginal effects of MDA at $p < 0.1$ for those firms with compensation strategy (in outcome 1); thus supporting H2C. In regards to ENGO, the positive marginal effects were significant at $p < 0.01$ for firms adopting reduction strategy and all-rounder strategy (in outcome 2 and 3). In contrast, the negative marginal effects of ENGO at $p < 0.05$ confirmed less impact of perceived pressures from secondary stakeholders for firms adopting compensation strategy (in outcome 1). These results support H2C, which is consistent with Haque and Islam (2015) who suggested that ENGOs and media are powerful stakeholders in terms of the ability to exert coercive pressure on corporations to be accountable in relation to climate change. They also support the notion that secondary stakeholder pressure stimulates companies to adopt different types of proactive CMSs.

In regards to control variables, the findings suggest that those sample firms with compensation strategy were smaller in size and less leveraged. It therefore appears that the larger and more highly leveraged firms were more likely to have instead adopted reduction and all-rounder strategies. These results are consistent with Weinhofer and Hoffmann (2010), who reported that larger firms generally undertake a broader spectrum of activities to mitigate carbon emissions. That is the interactions of larger firms with society are generally more numerous and hold greater economic significance; such organisations also tend to be more visible. As a result, they often attract the attention of various stakeholders (Brown & Deegan, 1998; Patten, 2002); thus it is expected that large firms are especially driven to address environmental concerns (Hackston & Milne, 1996; Cormier & Magnan, 2003). Furthermore, larger firms usually have more resources to implement strategies involving multiple carbon management activities (Lee, 2012). This study's results indicate the proxy for industry (INDY) was not significant for any type of CMS adoption among the firm-year observations.

## 7.5 FURTHER ANALYSES

This section discusses the additional analyses that were conducted to check the robustness of the overall Phase 2(b) results as outlined above in Section 7.4. The relevant results are tabulated in Appendix B.

### 7.5.1 Random effect

This study employed a random effect model to address the possibility of any spurious relationships between the dependent and independent variables, which may arise due to the exclusion of any unmeasured explanatory variables. Table B.1 in Appendix B reported the result of random effect regression in model 2. The results did not differ qualitatively from the main findings shown in model 1. Consistent with these results, INS and MDA continued to show significant results, with MDA becoming less significant (at $p<.10$ compared to $p<.05$) while INS remained at the significance level of $p<0.05$. The only minor change was the coefficient for ENGO which changed to positive sign but was still insignificant.

### 7.5.2 Industry effect

GICS was also used to control for industry differences instead of a dummy variable for environmentally-sensitive versus non-environmentally-sensitive industry, with the results presented in Appendix B, Table B.2 based on the following 10 GICS industries: consumer discretionary (COND); consumer staples (CONS); energy (ENG); financials (FIN); health care (HCR); industrials (INDS); information technology (IT); material (MAT); telecommunication services (TCS); and utilities (UTL). When these GICS industry dummy variables along with the other variables were regressed based on different types of CMS adoption, the findings were consistent with the main results as shown in Table 7.3. Other than HCR, all the dummy industry variables were insignificant.

### 7.5.3 Alternative measures of control variable

To check the robustness of the results relating to stakeholder pressure and CMS adoption, this study used two alternative measures of firm size (FSIZE) as control variables. These results which are presented in Table B.3 in Appendix B have used a natural logarithm of each sample firm's revenue as a proxy of firm size. In outcome 1, INS, MDA and ENGO continued to show significant results with MDA and ENGO becoming more significant (at $p<.01$ compared to $p<.05$) while INS remained at the significance level of $p<0.10$. For outcomes 2 and 3, INS, MDA and ENGO continued to show significant results, with MDA becoming more significant (at $p<.01$ compared to $p<.05$) while INS and ENGO remained at the significance level of $p<0.05$ and $p<0.01$ respectively. Overall, these results were consistent with the main findings of this study as shown in Table 7.3.

Furthermore, the results remained unchanged when a natural logarithm of each sample firm's market capitalisation was used as a proxy of firm size. Table B.4 in Appendix B presents these results.

## 7.6 DISCUSSION OF PHASE 2(b) FINDINGS

This study has set out to investigate whether the company's likelihood to adopt a CMS depends on pressure from certain groups of stakeholder. As introduced in Chapter 5, this study identified three main CMS types: (1) compensation strategy; (2) reduction strategy; and (3) all-rounder strategy. A company is considered as adopting compensation strategy if it participates in any regional and/or international ETSs or to increase emissions limits by purchasing emissions allowances. In contrast, companies adopting reduction strategy tend to be leaders in the management of carbon emissions. Their carbon management activities involve designing new products that emit less carbon, improving existing products to be more carbon-free during their production, developing new production processes that emit less carbon, and improving existing processes to be carbon-free. Lastly, firms using all-rounder strategy not only focus on participating in ETS but also engage in a number of carbon management activities such as greener products development, emission reduction in innovative production process, and investment in energy-efficient projects among others.

The literature has provided empirical evidence of how pressure from stakeholders affects firms' environmental strategy adoption. A common corresponding focus has been to identify where the pressures come from – that is, who the salient stakeholder groups are (Henriques & Sadorsky, 1999; Buysse & Verbeke, 2003; Eesley & Lenox, 2006). Stakeholder salience is the degree to which managers give priority to competing stakeholder claims (Agle, Mitchell & Sonnenfeld, 1999). In line with this, the literature suggests that most firms will design a proactive environmental strategy in an attempt to respond to the stakeholder group they believe is most influential (Sharma & Henriques, 2005; Kassinis & Vafeas, 2006; Huang & Kung, 2010).

Among stakeholders, regulators are generally considered the most coercive force given their power and capabilities to establish environmental laws (Rugman & Verbeke, 1998). Regulation is a major driver of corporate climate strategy (Okereke, 2007). Other than regulators, primary stakeholders have a direct economic stake in the firm (Donaldson

& Preston, 1995) and include employees, shareholders, investors, customers and suppliers. They often also have an impact on the firm's decision to adopt an environmental strategy (Buzzelli, 1991).

Despite the ongoing importance of primary stakeholders, the rising influence of secondary stakeholders has been one of the most significant developments (Doh & Guay, 2006). Secondary stakeholders generally relate to community groups, ENGOs and the media, and have the capacity to mobilise public opinion in favour of or in opposition to the firm (Freeman, 1984). These stakeholders often use indirect approaches to influence firm behaviour because they lack a direct economic stake in the organisation (Sharma & Henriques, 2005).

Regardless of the common perception of their power, this study did not find a significant relationship between regulatory stakeholder pressure and different types of CMS adoption, therefore H2A is rejected. This lack of a significant relationship could be due to the political vacuum to address climate change in Australia – that is, companies do not solely rely on the reporting of carbon emissions under the *NGER Act 2007,* but also use various voluntary initiatives to mitigate carbon emissions via CMS adoption. In line with this, Pinkse and Busch (2013) argued that in the absence of clear government regulations globally, numerous firms have decided to constrain their impact on the environment via a self-created carbon norm in response to various stakeholder pressures.

These results reinforce a very important point. That is, mandatory reporting of GHG emissions is only one of many policy levers that need to be pulled. Firms particularly those intending to be leaders in their field, should consider all of the strategic options for reducing GHG emissions, including the development of innovative low-emission technologies (Clemens, Bamford & Douglas, 2008). They need to consider the creation of composite business strategies that combine competitive product and process automation and innovation, positive pollution reduction behaviours within their industry group, and participation in regulatory mechanisms such as emissions trading (Christmann, 2000; Delmas & Toffel, 2004; Kolk & Pinske, 2004; Antes, 2006; Pinske, 2007; Martin & Rice, 2010). Hence, companies often respond to their various stakeholder pressures via a more holistic approach to adopt different types of CMS.

These results also reaffirm the important role played by primary stakeholders such as institutional investors in pushing CMS adoption to be in the corporate agenda. Institutional investors are perceived to be one of the most powerful stakeholders in generating climate-change-related concern and coercive pressure on corporations to be accountable (Haque & Islam, 2015). In support of the tenets of stakeholder theory, Cotter and Najah (2012) suggested that a powerful stakeholder coalition of institutional investors stimulates corporate climate change disclosure.

As firms that adopt reduction and all-rounder strategies often undertake a broader spectrum of activities to mitigate carbon emissions (Weinhofer & Hoffmann, 2010), they are more likely to react to pressure from institutional investors. In contrast, firms with compensation strategy often reflect a more reactive posture. Their main focus is to respond to the pressure of regulatory stakeholders. They are less likely to perceive pressure from institutional investors as they have limited resources to mitigate their carbon emissions. This study therefore finds support for H2B.

In addition, this study has also found evidence that firms adopting reduction and all-rounder strategies are more likely to attach importance to secondary stakeholder pressure. This holds true for both of this study's proxies of secondary stakeholders: media (MDA) and ENGOs (negative publicity). MDA and ENGOs are often considered as a vital factor in shaping community concerns and expectations (Haque & Islam, 2015). Furthermore, as most large firms adopt reduction and all-rounder strategies, they are generally subject to greater scrutiny from MDA and ENGOs. In contrast, firms that adopt compensation strategy have a narrower focus in relation to stakeholder pressures, and do not generally use their initiative to mitigate carbon emissions via process improvement or product development. Moreover, they are less often in ENGO's limelight due to their limited approach towards reducing carbon emissions. Hence, they are less likely to perceive pressure from secondary stakeholders. This study therefore finds support for H2C.

In summary, these findings are in line with the arguments espoused in stakeholder theory that the firms' actions such as proactive CMS adoption are often a response to stakeholders' requirements, expectations and preferences. The results of this study have also shown a relationship between perceptions of stakeholder pressure and the adoption

of different types of CMS. Thus, CMS adoption could be viewed as a tool that helps to achieve stakeholder expectations and maintain beneficial relationships with them.

## 7.7 CHAPTER SUMMARY

The findings in relation to Phase 2(b) have been discussed in this chapter, which was focused on exploring the relationship between stakeholder pressure and different types of CMS adoption. These results reveal that firms which adopt reduction and all-rounder strategies are more likely to attach importance to primary as well as secondary stakeholders. In contrast, companies with compensation strategy are less likely to devote much time or resources to managing these stakeholder groups. This study has failed to identify any significant relationship between regulatory stakeholder pressure and different types of CMS adoption. In summary, the findings confirm that the company's philosophy and conviction to adopt CMS is very much related to increasing pressure from various stakeholders. A summary of these results are presented in Table 7.4. The next Chapter 8 discusses the findings in relation to RQ4 examining whether financial as well as carbon performance are related to CMS adoption.

**Table 7.4: Summary of results of testing hypotheses H2A, H2B and H2C**

| Hypotheses | Testing procedure | Dependent variable | Results | Supported/ not supported |
|---|---|---|---|---|
| H2A: The perceived pressure from regulatory stakeholders is more likely for firms adopting compensation strategy and less likely for firms adopting reduction strategy as well as all-rounder strategy. | The marginal effects of REG variable in Equation (2) were estimated using ordered probit regression and were expected to be statistically significant. | Compensation strategy | Marginal effect was positive but insignificant. | Not supported |
| | | Reduction strategy | Marginal effect was negative but insignificant. | Not supported |
| | | All-rounder strategy | Marginal effects were negative but insignificant. | Not supported |
| H2B: The perceived pressure from primary stakeholders is more likely for firms adopting reduction strategy and all-rounder strategy and less likely for firms adopting compensation strategy. | The marginal effects of EMP and INS variables in Equation (2) were estimated using ordered probit regression and were expected to be statistically significant. | Compensation strategy | Marginal effects of EMP were negative but insignificant. | Not supported |
| | | | Marginal effects of INS were negative and significant at the 10% level. | Supported |
| | | Reduction strategy | Marginal effects of EMP were positive but insignificant. | Not supported |
| | | | Marginal effects of INS were positive and significant at the 5% level. | Supported |
| | | All-rounder strategy | Marginal effects of EMP were positive but insignificant. | Not supported |
| | | | Marginal effects of INS were positive and significant at the 5% level. | Supported |
| H2C: The perceived pressure from secondary stakeholders is more likely for firms adopting reduction strategy and all-rounder strategy and less likely for firms adopting compensation strategy. | The marginal effects of MDA and ENGO variables in Equation (2) were estimated using ordered probit regression and were expected to be statistically significant. | Compensation strategy | Marginal effects of MDA and ENGO were negative and significant at the 10% and 5% levels respectively. Marginal effects of MDA and ENGO were positive and significant at the 5% and 1% level respectively. | Supported |
| | | Reduction strategy | Marginal effects of MDA and ENGO were positive and significant at the 5% level. | Supported |
| | | All-rounder strategy | Marginal effects of MDA and ENGO were positive and significant at the 5% level. | Supported |

# CHAPTER 8

# CMS ADOPTION: IMPACT ON PERFORMANCE – EMPIRICAL RESULTS

## 8.1 INTRODUCTION

The purpose of this chapter is to present and discuss the results of Phase 2(c) related to RQ4: Do companies' CMS adoption relate to their financial as well as carbon performance? The chapter is structured as follows. Section 8.2 presents the descriptive statistics of the variables in relation to this study's firm-year observations. Then in Section 8.3, a correlation matrix portrays the nature of relationships among the different hypotheses proposed to answer RQ4. Section 8.4 next presents the empirical results of the OLS estimations of Equations (3) and (4). In Section 8.5, further analyses are conducted to check the robustness of the results using for alternative measures of financial and carbon performance with two different estimation techniques (random effect and industry effect). Section 8.6 next discusses the results of the two hypotheses tested, followed by Section 8.7 which summarises the findings.

## 8.2 DESCRIPTIVE STATISTICS

Table 8.1 presents descriptive statistics for the CMS adoption, performance and firm-characteristics variables. Panel A contains the nominal variables and Panel B the continuous variables. Of the 919 firm-year observations in this study between 2008 and 2012, a total of 625 of the ASX 200 firms (68%) have adopted CMS. Panel A also shows that most of the firms (61.48%) belonged to an environmentally-sensitive industry (INDY). However, less than half (38.96%) were required to disclose carbon emissions data under the *NGER Act 2007*.

As revealed in Panel B, there was considerable diversity in the characteristics of the sample. The financial performance (FPRF) measure had an inter-quartile range of 0.041 to 0.129, with a mean (standard deviation) of 0.088 (0.133). In addition, carbon

performance (CPRF) had a mean of 5.133 and a standard deviation of 2.253. On average, the sample firms had 5.133 tons of carbon emissions per AUD$1 million of sales revenue. The firms also varied considerably in terms of size, leverage and growth. The natural log of the sample firms' total assets (FSIZE) had an inter-quartile range of 20.276 to 22.546, with a mean (standard deviation) of 21.475 (1.856). On average, the firms were somewhat levered, with a mean (standard deviation) debt-to-assets ratio (LEV) of 0.240 (0.196). In addition, growth (GRTH) had an inter-quartile range of -0.066 to 0.218, with a mean (standard deviation) of 0.054 (0.185).

**Table 8.1: Descriptive statistics**

| **Panel A: Nominal variables** | | | | | |
|---|---|---|---|---|---|
| **Variables** | **Frequency (n=)** | | | **Percent** | |
| ***CMS*** | | | | | |
| Without CMS | 294 | | | 32 | |
| With CMS | 625 | | | 68 | |
| **Total** | **919** | | | **100** | |
| ***INDY*** | | | | | |
| Not environmentally-sensitive INDY | 354 | | | 38.52 | |
| Environmentally-sensitive INDY | 565 | | | 61.48 | |
| **Total** | **919** | | | **100** | |
| ***REG*** | | | | | |
| Do not report under *NGER Act 2007* | 561 | | | 61.04 | |
| Report under *NGER Act 2007* | 358 | | | 38.96 | |
| **Total** | **919** | | | **100** | |
| **Panel B: Continuous variables** | | | | | |
| **Variables** | **Mean** | **Median** | **Std. Dev.** | **Q1** | **Q3** |
| FPRF | 0.088 | 0.077 | 0.133 | 0.041 | 0.129 |
| CPRF | 5.133 | 5.169 | 2.253 | 3.900 | 6.353 |
| FSIZE | 21.475 | 21.340 | 1.856 | 20.276 | 22.546 |
| LEV | 0.240 | 0.223 | 0.196 | 0.094 | 0.338 |
| GRTH | 0.054 | 0.054 | 0.185 | -0.066 | 0.218 |

CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; FPRF = financial performance is measured by ROA which is the ratio of income before interest and tax to total assets; CPRF (inverse of carbon intensity) = carbon performance is measured as tons of carbon emissions per AUD$1 million of sales revenue; FAGE = firm age is the number of years since the firm's inception; FSIZE = firm size is the natural logarithm of the firm's total assets; LEV = leverage is the ratio of total debt to total assets at the end of fiscal year; GRTH = growth is the change in sales divided by prior year sales.

## 8.3 CORRELATION MATRIX AND BIVARIATE ANALYSIS

Table 8.2 reports the parametric Pearson's product moment correlation (see the bottom left side of the table) and non-parametric Spearman's rank correlation (see the top right side of the table). Panel A shows the bivariate correlation matrix for all the H3A variables, while Panel B contains the H3B variables. In Panel A, the correlation between financial performance (FPRF) and CMS adoption among the sample firms was positive and significant. Pearson correlation estimates show that FPRF was positively correlated

with regulation (REG), and negatively related with growth (GRTH) and industry (INDY), and that these correlations were statistically significant. Spearman rank correlations show similar associations between the above-mentioned variables.

Among the firms' characteristics, firm size (FSIZE) had a significant negative relation with GRTH and INDY, while a significant positive relation was observed between FSIZE and leverage (LEV). Furthermore, LEV was positively correlated with GRTH, and inversely related to REG and INDY. In addition, GRTH was positively related to REG and INDY. These results show that none of the correlation coefficients between predictor variables was higher than 0.9. This aligns with Field's (2009) comment that a correlation of independent variables of above 0.80 is an indication of multicollinearity. The highest correlation coefficient between predictor variables was 0.480. This study also analysed the variance-inflation factors (VIF) and tolerance of explanatory variables among the firm-year observations. The analysis presented tolerances of 0.756, 0.630, 0.829, 0.981 and 0.919, and variance-inflation factors of 1.32, 1.59, 1.21, 1.02 and 1.09. The VIFs were all below 2 indicating the absence of multicollinearity (Pallant, 2007).

In Panel B, consistent with the expectation, both the Pearson and Spearman correlation coefficients for carbon performance (CPRF) and CMS adoption were positive and significant. Furthermore, the correlation coefficients between CPRF and all the control variables were in the expected directions, and were significant for financial performance (FPRF), firm size (FSIZE), leverage (LEV) and growth (GRTH) using both estimates. Pearson correlation estimates show that CPRF was positively correlated with FPRF, FSIZE and LEV, but negatively correlated with GRTH. Spearman rank correlations show similar associations between the above-mentioned variables.

Among the firms' characteristics, FSIZE had a significant positive relation with LEV, while a significant negative relation was observed with GRTH. Furthermore, LEV was inversely related to GRTH. Again, these results show that none of the correlation coefficients between predictor variables was higher than 0.80 implying that multicollinearity is not a cause for concern. The highest correlation coefficient between predictor variables was 0.270. Furthermore, the tolerance and VIF values were within

acceptable ranges of greater than 0.10 and less than 2 respectively, indicating no multicollinearity problems in the tested model (Dewberry, 2004).

**Table 8.2: Correlation matrix**

| ***Panel A: Bivariate correlations for H3A variables*** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variables** | **FPRF** | **CMS** | **FSIZE** | **LEV** | **GRTH** | **REG** | **INDY** |
| **FPRF** | 1.000 | 0.052* | -0.061 | -0.031 | -0.084*** | 0.066** | -0.075** |
| **CMS** | 0.043* | 1.000 | 0.480*** | 0.223*** | -0.200*** | 0.001 | -0.126*** |
| **FSIZE** | -0.039 | 0.476*** | 1.000 | 0.411*** | -0.406*** | -0.025 | -0.201*** |
| **LEV** | -0.025 | 0.204*** | 0.326*** | 1.000 | 0.278*** | -0.056* | -0.213*** |
| **GRTH** | -0.089*** | -0.095*** | -0.308*** | 0.057* | 1.000 | 0.059* | 0.254*** |
| **REG** | 0.057* | 0.001 | -0.027 | -0.057* | 0.020* | 1.000 | 0.036 |
| **INDY** | -0.097*** | -0.126*** | -0.204*** | -0.179*** | 0.087*** | 0.036 | 1.000 |
| ***Panel B: Bivariate correlations for H3B variables*** | | | | | | | |
| **Variables** | **CPRF** | **CMS** | **FPRF** | **FSIZE** | **LEV** | **GRTH** | **REG** |
| **CPRF** | 1.000 | 0.130*** | 0.065** | 0.217*** | 0.108** | -0.270*** | -0.022 |
| **CMS** | 0.105** | 1.000 | -0.045 | 0.206*** | 0.096** | -0.110** | 0.003 |
| **FPRF** | 0.104** | -0.055 | 1.000 | 0.082* | -0.092** | -0.031 | 0.017 |
| **FSIZE** | 0.243*** | 0.197*** | 0.187*** | 1.000 | 0.049* | -0.061* | 0.013 |
| **LEV** | 0.089** | 0.094** | -0.112*** | 0.074* | 1.000 | -0.012* | -0.020 |
| **GRTH** | -0.261*** | -0.111 | 0.017 | -0.073* | -0.085* | 1.000 | 0.004 |
| **REG** | -0.015 | 0.015 | 0.015 | 0.015 | -0.027 | 0.053 | 1.000 |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.
## Pearson product moment correlation is in the bottom left matrix, while Spearman's rank correlation is in the top right matrix.

FPRF = financial performance is measured by ROA which is the ratio of income before interest and tax to total assets; CPRF (inverse of carbon intensity)= carbon performance is measured as tons of carbon emissions per AUD$1 million of sales revenue; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's total assets; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0;

## 8.4 MULTIVARIATE ANALYSIS

### 8.4.1 Relationship between CMS adoption and financial performance

Table 8.3 presents the results of pooled-OLS estimates of regression Equation (3). The reported results are heteroskedasticity and autocorrelation consistent as per both Huber's (1964) and White's (1980) robust standard errors. The adjusted R-squared for the model is 3.90%. Although this is lower compared with most other studies, this model compares well with Aguilera-Caracuel and Ortiz-de-Mandojana (2013) and Nishitani and

Kokubu (2012) in the context of the relationship between GHG emissions and financial performance.

**Table 8.3: Regression results – CMS adoption and financial performance**

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* | *Tolerance* | *VIF* |
|---|---|---|---|---|---|---|
| Dependent variable: | FPRF | | | | | |
| Constant: | C | | 0.321 | **0.001*** ** | | |
| Independent variable: | CMS | + | 0.025 | **0.039** ** | 0.756 | 1.32 |
| Control variables: | FSIZE | + | -0.011 | **0.012** ** | 0.630 | 1.59 |
| | LEV | + | -0.006 | 0.797 | 0.829 | 1.21 |
| | GRTH | + | -0.009 | 0.164 | 0.864 | 1.16 |
| | REG | + | 0.016 | **0.072*** | 0.981 | 1.02 |
| | INDY | ? | -0.031 | **0.001*** ** | 0.919 | 1.09 |
| Year dummies | | | Included | | | |
| *Adjusted* $R^2$= 0.0390 | | *F-statistic* (10, 908) = 5.67 (0.001) | | | *Total observation =919* | |
| *** significant at 1% level; ** significant at 5% level; *significant at 10% level. | | | | | | |
| FPRF = financial performance is measured by ROA which is the ratio of income before interest and tax to total assets; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's total assets; LEV = leverage is the ratio of total debt to total assets at the end of fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0. | | | | | | |

In model 1 of Table 8.3, this study has examined the relationship between CMS adoption and the sample firms' financial performance (FPRF). The results show that the coefficient of CMS adoption variable was positive and significant ($\beta = 0.039$, $p < 0.05$); thus supporting H3A, which implies that firms with CMS are more likely to perform well financially than those firms without it. This result is consistent with the findings of prior studies (Hart & Ahuja, 1996; Russo & Fouts, 1997; Clarkson et al., 2011b; Albertini, 2013) that have showed a positive relationship between corporate environmental management and financial performance. Furthermore, in accordance with RBV predictions, H3A is supported indicating that indeed financial success and the CMS adoption go hand-in-hand. It is also similar to Porter's win-win argument which embodies the assumption that what is good for business is good for the environment (Drake, Purvis & Hunt, 2004). Firms that adopt CMS are likely to benefit from premium pricing and increased sales based on an enhanced corporate image and stronger social approval, which may also

provide environmentally-conscious organisations with opportunities to differentiate their products from their competitors.

In regards to control variables, the findings in Table 8.3 suggest that the smaller firms (FSIZE) and those which disclose carbon emissions under *NGER Act 2007* (REG) were more likely to have better financial performance (FPRF). Contrary to the expectation, firm size was found to be negatively related to FPRF. It has been suggested that larger firms have fewer growth opportunities and more coordination problems, which may negatively influence their performance (Morck et al., 1988). This result is consistent with King and Lenox (2001) who found a negative relationship between firm size and financial performance. In contrast, the positive coefficient for REG implies that firms that are more profitable are in a better position to cope with the costs of climate change and are therefore more likely to disclose their carbon emissions according to the *NGER Act 2007*. In addition, as evidenced by the negative sign of the coefficient for industry (IND), those firms in an environmentally-sensitive industry were often financially penalised for adopting CMS. However, the results also reveal that the proxy for leverage (LEV) and growth (GRTH) were not significant.

### 8.4.2 Relationship between CMS adoption and carbon performance

The next phase of the analysis entailed conducting an OLS regression to explore the association between CMS adoption and the sample firms' carbon performance (CPRF). A sub-sample of 517 firm-year observations that disclosed carbon emissions data was used in Model 2, and these results are presented in Table 8.4. The reported results are heteroskedasticity and autocorrelation consistent as per both Huber's (1964) and White's (1980) robust standard errors. The adjusted R-squared for the model is 14.87%.

As expected, the study documents a positive significant coefficient ($\beta = 0.463$, $p < 0.1$) for the CMS adoption variable, which suggests that those firms that adopted CMS were more likely to have better carbon performance. This is likely because CMS adoption recognises that the organisation needs to minimise its impact on the natural environment, and that a proactive corporate stance towards environmental responsibility is an important part of a firm's strategic objectives. Furthermore, CMS adoption involving the design of new products, processes or innovative technology could provide the firm with a strategic capability. Thus, the development of organisational capabilities via CMS

adoption often leads to the achievement of better carbon performance, which can enable firms to keep ahead of competitors.

**Table 8.4: Regression results – CMS adoption and carbon performance**

| Model 2 | | *Expected sign* | *Coefficient* | *Probability* | *Tolerance* | *VIF* |
|---|---|---|---|---|---|---|
| Dependent variable: | CPRF | | | | | |
| Constant | C | | -12.583 | **0.001*** ** | | |
| Independent variables: | *CMS* | + | 0..463 | **0.084*** | 0.941 | 1.06 |
| Control variables: | *FPRF* | + | 2.516 | **0.073*** | 0.923 | 1.08 |
| | *FSIZE* | + | 0.320 | **0.001*** ** | 0.894 | 1.12 |
| | *LEV* | + | 0.985 | 0.123 | 0.946 | 1.06 |
| | *GRTH* | - | -0.034 | **0.001*** ** | 0.959 | 1.04 |
| | *REG* | + | -0.084 | 0.670 | 0.983 | 1.02 |
| Year dummies | | | Included | | | |
| Adjusted $R^2$ = 0.1487 | | F-statistic (10, 506) = 5.28 (0.001) | | | Total observation = 517 | |
| *** significant at 1% level; ** significant at 5% level; *significant at 10% level. | | | | | | |
| CPRF = carbon performance is the inverse of carbon intensity which is measured as tons of carbon emissions per AUD$1 million of sales revenue; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FPRF = financial performance is measured by ROA which is the ratio of income before interest and tax to total assets; FSIZE = firm size is the natural logarithm of the firm's total assets; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0. | | | | | | |

In regards to control variables, the findings in Model 2 show that the proxy for financial performance (FPRF) has a positive coefficient ($\beta = 2.516$, $p < 0.1$). This result implies that profitable firms have low-carbon intensity[33] and thereby achieve better carbon performance. This finding is consistent with Boiral's (2006) study in Canada, wherein a win-win relationship was shown between the commitment to reduce carbon emissions and financial performance. However, Delmas and Nairn-Birch (2011) counteracted this win-win perspective when suggesting that firms are often financially penalised for reducing GHG emissions.

In addition, this study's results show that the sample firms' size (FSIZE) was positively related to carbon performance ($p < 0.01$), affirming that larger firms are more likely to achieve better carbon performance (CPRF). This is often due to large firms often have more resources to invest more in environmentally friendly technologies (Clarkson

[33] Recall that the study reverses the sign of carbon intensity (total emissions/sales) to facilitate the interpretation.

et al., 2011b). Furthermore, this study identified a significant inverse relationship between growth (GRTH) and carbon performance (CPRF) ($\beta$ = -0.034, $p < 0.01$), suggesting that firms with more growth opportunities are less likely to have better carbon performance (CPRF). While this appears to contradict the arguments embodied in RBV, it is conceivable that firms with higher growth opportunities are continually in an expansionary period, requiring funding to finance such expansion. Hence, they often have fewer resources for carbon reduction activities (Dhaliwal, Li, Tsang & Yang, 2011). Lastly, these results reveal that the proxy for leverage (LEV) and regulation (REG) were not significant across the firm-year observations.

## 8.5 FURTHER ANALYSES

This section discusses the additional analyses that were conducted to check the robustness of the overall Phase 2(c) results as outlined in Section 8.4 pertaining to relationships between CMS adoption and financial performance, and CMS adoption and carbon performance. The relevant results of these further analyses are tabulated in Appendix C.

### 8.5.1 CMS adoption and financial performance

#### *8.5.1.1 Alternative measure of financial performance*

ROE was used as an alternative measure of the firms' financial performance. ROE is measured as the ratio of net income to stakeholders' equity (Busch & Hoffmann, 2011; Alvarez, 2012) – it is generally deemed a measure of shareholder return (Cohen et al., 1997). These results, which are reported in Table C.1 in Appendix C, are consistent with the main findings (as shown in model 1 of Table 8.3). That is, there was a positive and significant relationship ($\beta$ = 0.043, $p < 0.1$) between CMS adoption and financial performance (FPRF) among the sample firms.

#### *8.5.1.2 Random effect*

A random effect model was also employed to address the possibility of any spurious relationships between the dependent and independent variables, which may arise due to the exclusion of any unmeasured explanatory variables. According to this analysis, there are no qualitative differences from the main findings. These results, as reported in Table C.2 in Appendix C, are therefore consistent with the main findings (as shown in

model 1 of Table 8.3). CMS adoption continues to show significant results and remains at the same significance level of $p<0.05$.

#### *8.5.1.3 Industry effect*

GICS was used to control for industry differences instead of a dummy variable for environmentally-sensitive versus non-environmentally-sensitive industry, based on the 10 GICS industries: consumer discretionary (COND); consumer staples (CONS); energy (ENG); financials (FIN); health care (HCR); industrials (INDS); information technology (IT); material (MAT); telecommunication services (TCS); and utilities (UTL). The results, as presented in Table C.3 in Appendix C, reaffirm that firms that adopt CMS are more likely to have better financial performance. Across the firm-year observations, all the industry control variables were significant except for COND and HCR, and a positive significant coefficient was found for both INDS and IT. In contrast, the coefficients for CONS, ENG, FIN, MAT and UTL were negative and significant.

### 8.5.2 CMS adoption and carbon performance

#### *8.5.2.1 Alternative measure of carbon performance*

To check the robustness of model 2 in Table 8.4, this study measured carbon performance based on the sample firms' direct carbon emissions (Scope 1) instead of the total emissions that include the three scopes[34]. These results, as presented in Table C.4 of Appendix C, are consistent with the main findings reported in Table 8.4. That is, the study has identified a significantly positive relationship between CMS adoption and carbon performance ($\beta = 0.931$ and $p = 0.028$).

#### *8.5.2.2 Alternative measure of financial performance*

This study used ROE as an alternative measure of financial performance. These results, as reported in Table C.5 in Appendix C, indicate a positive significant coefficient for ROE ($\beta = 1.246$, $p < 0.1$). Overall, the results are consistent with the main findings, which reaffirms that firms with CMS are more likely to have better carbon performance.

[34] Scope 1 emissions are direct GHG emissions from sources that are owned or controlled by the entity; Scope 2 emissions are indirect GHG emissions resulting from the generation of electricity, heating and cooling, or steam generated offsite but purchased by the entity; Scope 3 emissions include indirect GHG emissions from sources not owned or directly controlled by the entity but related to the entity's activities (Clean Energy Regulator, 2013).

#### *8.5.2.3 Random effect*

This study utilised a random effect regression as an alternative estimation technique. Table C.6 in Appendix C reports the results of this random effect model, which show the coefficient of the CMS adoption variable as positive and significant ($\beta = 0.463$, $p < 0.1$). This implies that firms with CMS are more likely to reduce carbon intensity[35], and thereby achieve better carbon performance. This is consistent with the main findings as shown in model 2 of Table 8.4.

#### *8.5.2.4 Industry effect*

It is commonly known that industries where business operations emit greater levels of harmful GHGs are more likely to generate greater public and regulatory concern (Rankin et al., 2011). Management of GHG emissions therefore directly affects the energy industries, or those industries which depend on fossil fuels such as coal, oil, automobiles, power generation and airlines (Kolk et al., 2008). GICS was used to control for industry differences instead of a dummy variable for environmentally-sensitive versus non-environmentally-sensitive industry, based on the following nine[36] GICS industries: consumer discretionary (COND); consumer staples (CONS); energy (ENG); financials (FIN); health care (HCR); industrials (INDS); information technology (IT); material (MAT); and utilities (UTL). These results, as presented in Table C.7 in Appendix C, show that those firms that adopted CMS were more likely to have better carbon performance. In regards to industry dummy variables, COND, ENG, MAT and UTL variables were significant, with negative coefficients for ENG, MAT and UTL, and a positive coefficient for COND.

## 8.6 DISCUSSION OF PHASE 2(c) FINDINGS

This phase of the study has set out to examine the relationship between CMS adoption, financial performance and carbon performance. Within the environmental strategic management literature, some researchers have argued that the ability to integrate the natural environment into the strategic planning process is a unique organisational capability (e.g. Russo & Fouts, 1997; Judge & Douglas, 1998; Aragon-Correa & Sharma, 2003). Yet most of these studies have sought to identify the specific capabilities developed

[35] Recall that the study reverses the sign of carbon intensity (total emissions/sales) to facilitate the interpretation.

[36] Firms in the sample have been categorised into nine instead of ten industries, as there was no firm that belonged to the telecommunication services industry that disclosed carbon emissions.

by firms adopting more proactive environmental strategies, and their contribution to sustained competitive advantage. Carbon emissions management can lead to a range of economic benefits, including better access to certain markets, and enhanced ability to offer differentiated products and to sell pollution-control technology. Thus, it is conceivable that CMS adoption enables firms to develop their organisational capabilities, which can improve their financial performance via differentiation from the competition.

Existing natural environment literature generally suggests a positive relationship between proactive firm efforts to reduce negative environmental impacts and firm-level financial performance (e.g. Hart & Ahuja, 1996; Russo & Fouts, 1997). That is, preventing pollution can enable a firm to eliminate environmentally-hazardous production processes, redesign existing product systems to reduce lifecycle impacts, and develop new products with lower lifecycle costs (Hart, 1995). As a result, more advanced environmental strategies can assist organisations in achieving greater organisational efficiency (e.g. Hart & Ahuja, 1996; Christmann, 2000; Nakamura, 2011). In line with this, it follows that firms develop better capability to achieve better carbon performance when they adopt CMS, which can also help them stay ahead of competitors.

This study's empirical analyses confirm that firms which adopt CMS are more likely to have better financial performance providing support for H3A. Such a positive relationship supports the 'it pays to be green' notion which argues that money spent on GHG reductions would be beneficial for a firm's competitiveness (Aragon-Correa et al., 2008). Through CMS adoption, a firm recognises that its environmental practices are different from that of its competitors, which is often linked with better financial performance.

Similarly, this study has found evidence that firms that adopt CMS often experience better carbon performance providing support for H3B. Hence, CMS adoption can be a source of value for the firm in two ways. First, such a source of value influences the reputation of the firm and its products – for example, firms that produce environmentally-friendly products that emit less carbon are generally viewed as responsible and compliant by both government and society. Second, superior financial performance often results from consumer recognition of a firm's commitment to green products, which in turn can generate additional revenue via customer loyalty. In addition,

managing carbon emissions enables firms to save on pollution-control costs, input and energy consumption, and to reuse materials through recycling. Thus, CMS adoption is likely to be a strategic resource that contributes to a firm's competitive advantage in terms of better financial and carbon performance.

Building on the RBV paradigm, the relationships between CMS adoption, financial performance and carbon performance has proven to be logical in this study's findings. This aligns with the RBV explanation that the identification and possession of internal strategic resources contribute to a firm's ability to create and maintain a competitive advantage and improve performance (Barney, 1991; Hart 1995; Crook et al. 2008;). In relation to carbon emissions management, there are at least two types of competitive advantage – cost advantage and differentiation advantage – that can emerge from CMS adoption. Cost advantage results from environmental production processes that include redesigning production to be less polluting and using energy-saving appliances or manufacturing processes (Clarkson et al., 2011b; Albertini, 2013). Such practices are intended to reduce the production cost by increasing the efficiency of production processes via the reduction of input and waste during the manufacturing process (Clarkson et al., 2011b; Aguilera-Caracuel & Ortiz-de-Mandojana, 2013). Differentiation advantage often results from best-practice environmental management that focus on product characteristics and the product market. These product-focused aspects include redesigning packaging, producing in more environmentally-responsible ways, and developing environmentally-friendly products. In addition, the differentiation advantage leverages the potential to increase product prices, which can achieve higher revenues (Albertini, 2013).

Another key finding from this study is that the development of organisational capabilities via CMS adoption is likely to reduce the impact of the firm's operations on the natural environment. This is consistent with Hart (1995) who identified an increase in companies 'going green' to reduce pollution and increase profits simultaneously. Such companies also consider that the excess returns resulting from unique environmental capabilities will enable them to employ profitable environmental strategies that are difficult to imitate.

Thus, as CMS adoption does not appear to conflict with firms' economic incentives, managers implement responsible carbon management practices via CMS adoption to improve both their financial and carbon performance.

## 8.7 CHAPTER SUMMARY

This chapter has presented the empirical results for hypotheses H3A and H3B. With regard to hypothesis H3A, after controlling for firm-specific variables, financial performance was found to positively relate to CMS adoption. Similarly, firms that adopt CMS are more likely to have better carbon performance. These overall findings suggest that CMS adoption enables firms to manage climate change related risks and opportunities in the business environment. In particular, it can leverage competitive advantages for a company. A summary of these results is presented in Table 8.5.

**Table 8.5: Summary of results of testing hypotheses H3A and H3B**

| Hypothesis | Testing procedure | Dependent variable | Results | Supported/ not supported |
|---|---|---|---|---|
| H3A: Firms that adopt CMS are more likely to have better financial performance compared with firms that do not adopt CMS. | The coefficient of CMS adoption variable (β1) in Equation (3) was estimated using OLS regression, and was expected to be statistically significant. | Financial performance | β1 was positive and significant at the 10% level. | Supported |
| *Further analysis:* | i) Alternative measure of financial performance | Financial performance | β1 was positive and significant at the 10% level. | Supported |
| | ii) Random effect | Financial performance | β1 was positive and significant at the 5% level. | Supported |
| | iii) Industry effect | Financial performance | β1 was positive and significant at the 5% level. | Supported |
| H3B: Firms that adopt CMS are more likely to have better carbon performance compared with firms that do not adopt CMS. | The coefficient of CMS adoption variable (β1) in Equation (4) was estimated using OLS regression, and was expected to be statistically significant. | Carbon performance | β1 was positive and significant at the 10% level. | Supported |
| *Further analysis:* | i) Alternative measure of carbon performance | Carbon performance | β1 was positive and significant at the 5% level. | Supported |
| | ii) Alternative measure of financial performance | Carbon performance | β1 was positive and significant at the 10% level. | Supported |
| | iii) Random effect | Carbon performance | β1 was positive and significant at the 10% level. | Supported |
| | iv) Industry effect | Carbon performance | β1 was positive and significant at the 5% level. | Supported |

# CHAPTER 9

# SUMMARY AND CONCLUSION

## 9.1 INTRODUCTION

The purpose of this chapter is to provide a brief summary and to report on the conclusions arrived at in relation to the main findings from the two phases of research undertaken for this study. This chapter is structured as follows. Section 9.2 presents a brief review of the research background and objectives of this study, followed by Section 9.3 which delineates the summary and conclusions reached from each of the two phases of this study. This is followed by a discussion on research contributions in Section 9.4, with the research implications then presented in Section 9.5. Section 9.6 identifies the limitations of this study, while Section 9.7 outlines some suggestions for future research in line with this study's findings and conclusions. The chapter is then summarised in Section 9.8.

## 9.2 BRIEF REVIEW OF RESEARCH BACKGROUND AND OBJECTIVES

Concerns about the importance of managing environmental issues particularly climate change are increasing, with scientific (Intergovernmental Panel on Climate Change, 2011), economic (Stern, 2006, 2009) and political (Gore, 2006, 2009) evidence emphasising that urgent action is required. Climate change experts are focused on shifting to low-carbon energy strategy to reduce carbon emissions (Stern, 2008). Thus, the motivation for this study emerged from the idea that carbon management plays a crucial role in the transition to a low-carbon future.

Given the growing importance of climate change, different stakeholder groups have firmly placed climate change on corporate agendas; thereby expecting organisations to respond to the issue and disclose relevant information. Firms are correspondingly beginning to realise this by mitigating and managing exposure to climate change risks

while also seeking new opportunities (Lash & Wellington, 2007; Porter & Reinhardt, 2007). Organisations are therefore increasingly responding to climate-induced market shifts by undertaking a range of carbon management activities (Levy & Egan, 2003; Kolk & Pinkse, 2004, 2005).

The notion of viewing the management of GHG emissions from a strategic management perspective is a relatively new area of research. However, as the actual strategic influences of climate change on firms have been increasing, some researchers have endeavoured to gain a better understanding of corporate carbon management activities in response to climate change (Kolk & Pinkse, 2005; Lee, 2012). Such prior research suggests that companies efficiently managing climate change achieve long-term strategic benefits, and in many cases gain a competitive advantage (Hoffman, 2005; Porter & Reinhardt, 2007).

In view of this, the objectives of this study were to investigate the various CMSs adopted by Australia's top 200 ASX-listed firms, and to examine the impact of internal organisational factors and stakeholder pressure in driving the adoption of CMS. This study has subsequently analysed the relationships between financial performance, carbon performance and CMS adoption during the period of 2008 to 2012. The objectives of the study correspond to two phases of research investigation as shown in Table 9.1. The sources of data and the main method of analysis used are also summarised in this table.

**Table 9.1: Research objectives, data sources and methods of analysis**

| Research objectives | Study phases | Sources of data and methods of analysis used |
|---|---|---|
| 1. To provide an in-depth investigation of the current status of CMS adoption in Australian context. | Phase 1 (Qualitative) | • Company websites, CDP survey responses, annual reports and sustainability reports<br>• Content analysis |
| 2. To examine the internal drivers of CMS adoption. | Phase 2 (a) (Quantitative) | • Company websites, annual reports, sustainability reports, and DatAnalysis database<br>• Logit regression analysis |
| 3. To explore if there are significant differences in stakeholder pressure for companies that adopt different types of CMS. | Phase 2 (b) (Quantitative) | • Company websites, annual reports, sustainability reports, and Factiva and DatAnalysis databases<br>• Ordered probit regression analysis |
| 4. To examine the relationships between firms' CMS adoption, financial performance and carbon performance. | Phase 2 (c) (Quantitative) | • Company websites, annual reports, sustainability reports, Clean Energy Regulator website, and DatAnalysis database<br>• OLS regression analysis |

A framework based on RBV, legitimacy theory and stakeholder theory provided the theoretical underpinnings for this study. RBV explains that the identification and possession of internal strategic resources contributes to a firm's ability to create and maintain a competitive advantage and improve performance (Barney, 1991; Hart 1995; Crook et al., 2008). In contrast, legitimacy theory posits that an organisation exists to the extent that society considers it to be operating within the bounds of its licence to operate – that is, the social contract (Dowling & Pfeffer, 1975; Deegan, 2002; O'Donovan, 2002). This means that an organisation is more likely to survive, obtain resources, and justify its rights and competence if it is endowed with legitimacy (Baum & Oliver, 1991). Despite the difference, the legitimacy perspective complements and consolidates RBV in three ways. First, from a broader view of resources, legitimacy is integral and a valuable asset to firms (Barney, 1991). Second, legitimacy invites and generates continuous resource supplies from the environments (Hall, 1992). Third, legitimacy leads to enhanced strategic position and is necessary for establishing sustainable competitive advantages.

Yet while legitimacy theory considers the whole society, it does not recognise that society comprises of numerous members (stakeholders) with diverse powers, interests and abilities to stimulate the activities of the firm (Deegan, 2002). To address this gap, stakeholder theory suggests that management must satisfy multiple stakeholder groups

(e.g. the government, the general public, NGOs, competitors, employees, clients) that have some interest or 'stake' in a firm and can influence its outcome (e.g. McWilliams, Siegel & Wright, 2006). This theory is premised on the notion that a company's continued existence depends on the continuing support of its stakeholders; as such, the activities of the corporation must meet their expectations. Furthermore, to help improve their competitive posture, companies need to manage and understand the conflicting interests of their stakeholders, and thereby develop specific capabilities to manage these pressures (Rueda-Manzanares et al., 2008). Hence, stakeholder theory also complements RBV.

In responding to stakeholder pressures to adopt environmentally-friendly practices, RBV posits that companies need to build the necessary capabilities to be able to compete more effectively. In this sense, stakeholder theory, legitimacy theory and RBV see the organisation as part of a broader social system that influences and is influenced by the expectations of other parties within that social system. A joint consideration of these complementary theoretical perspectives is believed to provide a richer and more complete picture to understand what motivates companies to adopt CMS and how it impacts on firm performance in the context of a high GHG emitting country like Australia.

Australia provides an appropriate context for this study as Australia's high energy consumption and reliance on fossil fuels has caused significant carbon emissions. As a nation with the highest rate of carbon emission per person in the developed world, climate change policy has started to dominate Australian public debates. As a result, many of Australia's larger companies are reporting on energy and GHG emissions, and pursuing energy-efficiency opportunity assessment programs under the requirements of the *NGER Act 2007* and the *Energy Efficiency Opportunities Act 2006* (*EEO Act 2006*). Moreover, the 2012 Australasian CDP report confirmed that Australian firms are increasingly considering climate change and related carbon emission issues alongside core business drivers. As such, Australia offers a unique setting to investigate the drivers of corporate CMS adoption and its impact on financial and carbon performance.

In the next section, a summary of this study's main findings together with the conclusions drawn from each of the two phases are discussed and presented.

## 9.3 SUMMARY AND CONCLUSION

### 9.3.1 Phase 1: Different types of CMS adoption

In Phase 1 (related to RQ1), the study investigated various CMSs adopted by Australia's top 200 ASX-listed firms. In keeping with the literature reviewed in relation to climate change and CMS, coding criteria were also used to identify those firms that adopted CMS. Table 4.2 of Chapter 4 described the criteria used to identify each of the following CMS types: compensation strategy; reduction strategy; and all-rounder strategy. Compensation strategy describes the action taken by a company to balance or offset its carbon emissions, such as purchasing GHG reduction credits from an offset scheme provider (Pinkse, 2007; Weinhofer & Hoffmann, 2010; Sprengel & Busch, 2011). In contrast, reduction strategy relates to companies' initiatives to improve carbon emission efficiency by substituting input factors or modifying products or production processes to actually reduce carbon emissions (Jeswani et al., 2008). It appeals to intuition that companies desiring to achieve carbon neutrality quickly will simultaneously engage both compensation and reduction activities; hence, they have been classified as adopting an all-rounder strategy.

The overall study results show an increasing trend in the number of ASX 200 firms that adopted CMS from 2008 to 2012. Furthermore, reduction strategy was found to be the dominant (around 82%) CMS adoption category over this five-year period. These results suggest that some Australian companies have taken a proactive but pragmatic stance motivated by addressing multiple risks posed by climate change to ascertain a competitive advantage (Dietz et al., 2007; Kolk & Pinkse, 2008b). Furthermore, these companies generally recognise the long-term and global impacts of climate change on the survival and growth of their businesses (Rankin et al., 2011).

The results also reveal that 95% of the sample companies that adopted compensation strategy had participated in a regional and/or international ETS, while 72% of these sample companies increased emissions limits by purchasing emissions allowances. In contrast, making existing production processes carbon-efficient was the dominant (around 95%) approach among those sample companies that adopted reduction strategy. In terms of those companies that adopted all-rounder strategy, investing in energy-efficient projects and participation in ETS were the principal approaches. Making

existing products/services carbon-efficient was the least common approach among both sets of companies that adopted reduction strategy and all-rounder strategy.

This study also examined CMS adoption through the lens of RBV, which emphasises that internal resources and capabilities, when valuable, rare, inimitable and without equivalent substitutes, can lead to a sustainable competitive advantage (Barney, 1991). In the context of CMS, having the capability to design new products that emit less carbon or improving existing products to be carbon-free during their production and use has been deemed as a valuable resource (Lee, 2012). Firms adopting such an approach via the development of climate-related dynamic capabilities are often able to apply these when taking products and services to new markets, to achieve a competitive advantage over other firms that have not developed such skills (Porter & Van der Linde, 1995). Thus, the view taken in this study is that CMS adoption via the design of new products, processes and innovative technology could provide a firm with a rare capability and thereby a competitive advantage. Many of the more successful process improvements or new technologies have incorporated multiple levels of engagement, from upper management to employees, and extending even further through to the supply chain (Sarkis et al., 2010). For a company then seeking to imitate such a process or technology, the social relationships, deployment of human resources, and unique strategy used to select specific projects may not be externally visible, which can make this type of resource difficult to imitate.

CMS adoption generally refers to a firm's commitment to manage its carbon emissions across its business operations, and is often a unique combination of resources through which the firm develops capabilities. Such firms generate these capabilities as an incremental result of growth and expansion via underlying skills and knowledge. Capabilities may also stem from innovative products, improvement of existing processes, investment in energy-efficient projects, and participation in green supply chain management.

The overall conclusion drawn from the Phase 1 findings of this study is that there are three different types of CMS: (1) compensation strategy; (2) reduction strategy; and (3) all-rounder strategy adopted by Australia's top 200 ASX-listed firms. The discussion of different types of CMS is then extended to examine CMS adoption through the lens

of RBV. In view of this, CMS adoption can be treated as a strategic resource as it meets the criteria of valuable, rare, non-substitutable and inimitable resource. Furthermore, the development of organisational capability via CMS adoption often achieves a sustainable competitive advantage.

### 9.3.2 Phase 2(a): Internal drivers of CMS adoption

Using a sample of 894 firm-year observations of top 200 ASX-listed firms, Phase 2(a) has set out to examine whether internal organisational factors drive CMS adoption to maintain legitimacy. Drawing from legitimacy theory and relevant prior literature, hypotheses were developed, and binary logistic regression was then used to test H1A, H1B, H1C and H1D in relation to RQ2.

These analyses affirmed the key role of internal organisational factors such as EMS, environmental committee, board size and board independence in maintaining corporate legitimacy via CMS adoption. EMS is often used to design and enhance operations, processes and products to prevent negative environmental impact. Having an EMS is viewed as a proactive environmental practice (Darnall et al., 2008) that has often led to improved environmental performance (King et al., 2005). Phase 2(a)'s results indicate that firms experienced in implementing EMS are more inclined to adopt CMS; with an expectation that this will result in increased internal efficiency and external legitimacy. Similarly, given that most environmental committees are responsible for instigating proactive environmental strategies (Ashforth & Gibbs, 1990), these findings add validity to the argument that the presence of such committees increases the likelihood of CMS adoption, enabling the firm to uphold legitimacy. Furthermore, this study reaffirmed the influence a larger board and more independent board members has on climate change governance practices and stimulating divergent responses to climate change and related carbon emissions. In terms of this study's findings, there were significant positive relationships between board size, board independence and CMS adoption, confirming that these attributes were significant drivers of CMS adoption.

In regards to this study's control variables, these findings suggest that larger firms and highly leveraged firms are more likely to adopt a CMS. The negative sign of the coefficient for industry indicates that those sample companies in non-environmentally-sensitive industries had a higher propensity to adopt CMS. The results also confirmed

that the proxy for firm age was not significant among the firm-year observations. Furthermore, as shown in Section 6.5 of Chapter 6, the findings pertaining to hypotheses H1A to H1D were also robust to alternative measure of CMS adoption and industry effect, as well as the random effect estimation method.

Drawing from the complementary perspective of legitimacy theory and RBV, Phase 2(a) results confirm that CMS adoption, in conjunction with better governance mechanisms and voluntary EMS implementation, is an ideal way for firms to show their commitment to environmental sustainability and climate change mitigation to maintain corporate legitimacy. Such a legitimation response is deemed necessary because stakeholders add a new implicit clause to the social contract; a clause that represents societal expectations about how corporate carbon footprints should be managed. Hence, to keep the social contract intact and to maintain legitimacy, firms need to convince stakeholders that they are responding in line with their concerns about carbon emissions. Thus, this study has found that many firms are now undertaking a broader spectrum of activities to mitigate carbon emissions via CMS adoption. Furthermore, organisational legitimacy can provide critical social resources that facilitate and complement financial and physical resources. Firms that recognise the importance of achieving organisational legitimacy will proactively manage environmental issues by way of adopting CMS and hence develop organisational capability to gain competitive advantage.

### 9.3.3 Phase 2(b): Stakeholder pressure and CMS adoption

The aim of Phase 2(b) was to explore whether there are significant differences in stakeholder pressure for companies that adopt different types of CMS. Sourcing a sample of 850 firm-year observations of ASX 200 firms, this study used the stakeholder theory as a theoretical lens, and hypotheses were developed. Ordered probit regression was then used to test H2A, H2B and H2C in relation to RQ3.

With regard to the sources of stakeholder pressure, this study identified three main stakeholder groups: (1) regulatory; (2) primary; and (3) secondary. Regulatory stakeholders include government bodies which promulgate environmental regulations (Schrader, 1991; Porter & van der Linde, 1995). Primary stakeholders including employees, shareholders, investors, customers and suppliers often have the strongest impact on the firm's decision to adopt an environmental strategy, based on the formal relationships they have with the

firm (Clarkson, 1995; Mitchell et al., 1997). In contrast, secondary stakeholder such as competitors, community groups, ENGOs and the media are not engaged in formal transactions with the organisation (Clarkson, 1995; Henriques & Sadorsky, 1999; Buysse & Verbeke, 2003).

In relation to these three main stakeholder groups, this study did not find any significant relationships between regulatory stakeholders and different types of CMS adoption among the sample firms. This could be due to the absence of clear government directives within Australia to address climate change – that is, most of these companies did not solely rely on the reporting of carbon emissions according to *NGER Act 2007*. This result may also be explained by the fact that many firms opt for a go-it-alone[37] approach by adopting CMS in response to primary and secondary stakeholder pressure (Pinkse & Busch, 2013). Accordingly, many companies are proactively incorporating a climate change perspective into cleaner business operations via CMS adoption. This is becoming crucial within the global business environment, where the carbon-consciousness of various stakeholders continues to increase (Hoffman, 2007).

This study's results indicate that the relationships between the adoption of different CMSs (compensation, reduction and all-rounder strategies) and the importance of primary stakeholders are significant for institutional investors. Institutional investors are deemed the most influential primary stakeholders in relation to generating climate-change-related concern and coercive pressure on corporations to be accountable (Haque & Islam, 2015). In support of the tenets of stakeholder theory, Cotter and Najah (2012) suggested that a powerful stakeholder coalition of institutional investors stimulates corporate reporting. They benefit the most from sound corporate environmental practices because they provide financial resources that are tied to the firm (Hill & Jones, 1992). This result suggests that institutional investors are one of the main actors that could drive CMS adoption right at the forefront of corporate agenda. Firms that adopt reduction and all-rounder strategies which generally involve a broader spectrum of activities to mitigate carbon emissions (Weinhofer & Hoffmann, 2010) are more likely to perceive pressure from institutional investors. In contrast, firms with compensation strategy often reflect a more reactive posture. Their main focus is to respond to the pressure of regulatory

[37] In the absence of a global regulatory framework for climate change, firms often struggle about how to position themselves in relation to addressing this issue (Pinkse & Busch, 2013).

stakeholders. They are less likely to perceive pressure from institutional investors as they have limited resources to mitigate their carbon emissions. Employee was the other primary stakeholder proxy used in this study. The results failed to identify any significant relationship between employee pressure and different types of CMS adoption among the firm-year observations. This is consistent with Henriques and Sadorsky (1999) who did not find a relationship between a firm's proactive profile and organisational stakeholders such as employees.

In relation to secondary stakeholders, evidence was found in this study that firms that adopt reduction and all-rounder strategies are more likely to attach importance to secondary stakeholder pressure. This held true for both of this study's secondary stakeholder proxies – the media and ENGO. These results may be due to the fact that most large firms extensively involve themselves in carbon management activities by adopting reduction and all-rounder strategies, which means they are subject to greater scrutiny from media and ENGO than other firms that generally adopt compensation strategy. This is why firms that adopt a more proactive stance attach greater importance to secondary stakeholders, suggesting firms are likely to be interested in the development and transfer of best practices in the environmental area. In addition, as the media is often considered a vital factor in shaping community concerns and expectations, firms that adopt reduction strategy and all-rounder strategy are more likely to attach importance to media pressure. In contrast, firms that adopt compensation strategy often have a narrower focus in relation to carbon emissions mitigation. They are primarily concerned about meeting mandatory requirement and are therefore less likely to engage with secondary stakeholders. In the absence of regulation, it is likely that reactive firms would not even be concerned about environmental issues.

In regards to the control variables, this study's findings verified significant relationships between the sample firms' CMS adoption and their size and degree of leverage. That is, large and highly leveraged firms are more likely to undertake a broader spectrum of activities (i.e. reduction and all-rounder strategies) than smaller firms. These results also indicate that the proxy for industry was not significant among the sample firms. As shown in Section 7.5 of Chapter 7, the findings pertaining to hypotheses H2A to H2C were also robust to alternative measure of CMS adoption and industry effect, as well as the random effect estimation method.

Drawing from the complementary perspective of stakeholder theory and RBV, the Phase 2(b) results confirmed that firm's likelihood to adopt a CMS depends on pressure from certain groups of stakeholder. They adopt different types of CMS to manage the many perspectives and conflicting interests of stakeholders. The stakeholder theory provides an excellent theoretical lens as it is based on the proposition that a firm and its stakeholders are interdependent upon one another for resources, and that managers are responsible for maintaining this exchange relationship for the firm's survival. Thus, CMS adoption could be viewed as a tool used to meet the expectations of various stakeholders including maintaining good relationships with them. In responding to stakeholder pressures to adopt environmentally-friendly practices, RBV posits that companies need to build the necessary capabilities to be able to compete more effectively. This study's results suggest that firms that recognise the importance of managing conflicting stakeholder interests and address corresponding environmental issues via CMS are more likely to have developed unique organisational capability to gain sustainable competitive advantage as affirmed by the results in Phase 2(c) that follows.

### 9.3.4 Phase 2(c): CMS adoption and impact on financial and carbon performance

Using a sample of 919 firm-year observations of 200 ASX-listed firms, Phase 2(c) of this study focused on the relationships between the sample firms' CMS adoption and their financial performance and carbon performance. The study employed RBV of the firm as the theoretical framework, and OLS regression was used to test H3A and H3B in relation to RQ4.

These empirical analyses confirmed that firms that adopt CMS are more likely to have better financial performance. Such a positive relationship supports the 'it pays to be green' notion confirming RBV arguments that money spent on GHG reductions is beneficial for a firm's competitiveness (Aragon-Correa et al., 2008). Such augmented financial performance mostly stems from consumer recognition of the firm's commitment to green products, which in turn generates additional revenue based on customer loyalty. In addition, managing carbon emissions enables firms to save on pollution-control costs, input and energy consumption, and to reuse materials through recycling. Furthermore, this study identified that those sample firms that adopted CMS often experienced improvement in their carbon performance (based on a sub-sample of 517 firm-year observations which disclosed their carbon emissions). This implies that the

development of organisational capabilities via CMS adoption is likely to reduce the impact of the firm's operations on the natural environment through mitigation of carbon emission.

In regards to the control variables, this study's findings found that the smaller firms and those that are required to disclose carbon emissions under *NGER Act 2007* were more likely to have better financial performance. In contrast, the negative sign in the coefficient for the industry variable implied that those firms in environmentally-sensitive industries had a poorer financial performance. The results also indicated that the proxy for leverage and growth were not significant among the sample firms. Overall, in terms of carbon performance, the results revealed that the larger and more profitable firms had lower-carbon intensity and thereby achieved better carbon performance. In addition, the negative sign in the coefficient for the growth variable implied that those firms with lower growth were more likely to have superior carbon performance. The results also revealed that the proxies for leverage and regulation were not significant. As shown in Section 8.5 of Chapter 8, the findings pertaining to hypotheses H3A and H3B were also robust to alternative measures of financial performance and industry effect, as well as the random effect estimation method.

Drawing from the RBV perspective, the Phase 2(c) results confirmed that firms' CMS adoption is linked to their financial and carbon performance. CMS adoption is treated as a unique and difficult-to-imitate practice that simultaneously reduces the impact of the firm's operations on the natural environment via the mitigation of carbon emission and creates value for the firm in the form of better financial and carbon performance. Furthermore, it would appear that most firms addressing the climate change issue by adopting CMS have developed particular organisational capabilities. For example, CMS adoption often transforms the organisation, modifies manufacturing processes, and integrates carbon emissions management into day-to-day operations. Thus, CMS adoption via the design of new products and processes and innovative technology is likely to provide the firm with exclusive capabilities and consequently contribute to a competitive advantage.

## 9.4 CONTRIBUTIONS

This study contributes to the accounting literature in several ways. First, the key contribution of Phase 1 is its adoption of a more rigorous approach to the examination of CMS adoption, by considering the type of carbon emissions management information provided. It also considers various disclosure media, including annual reports, stand-alone reports, websites and other publicly available sources of information. This study has uncovered a range of mitigation activities that affect an organisation's ability to create, extend or modify its resource base in light of its environmental and strategic context. Furthermore, companies can develop capabilities that help to create a competitive advantage through CMS adoption. The relationship between CMS adoption and developing dynamic capabilities has been unexplored in the accounting literature. By identifying some of the underlying carbon management activities that firms use to move to a low-carbon economy, this research provides insights on how organisations build dynamic capabilities to mitigate carbon emissions.

Second, Phase 2(a) contributes to the existing environmental and carbon disclosure research by examining the internal organisational drivers of CMS adoption. Previous research has investigated a range of factors potentially associated with firms' climate change disclosures including firm size, leverage, profitability, shareholder resolutions, regulatory threats, and economic consequences (Freedman & Jaggi, 2005; Stanny & Ely 2008; Prado-Lorenzo et al., 2009; Reid & Toffel 2009). Yet it has mostly overlooked corporate governance and environmental management factors as key drivers of CMS adoption, which has been a strong focus in this study.

Third, Phase 2(b) of this study presents findings in an area where little evidence exists, i.e. providing insights on how firms adopt different types of CMS in response to various stakeholder pressures. It represents an extension of previous studies related to climate change (Kolk & Pinkse, 2005; Jeswani et al., 2008; Weinhofer & Hoffmann, 2010; Sprengel & Busch, 2011; Lee, 2012) by focusing on stakeholder pressure.

Fourth, Phase 2(c) reaffirms from empirical evidence the advantages of adopting CMS in terms of better firm performance. Accounting research on the topic of carbon strategy is a relatively new area; few studies have empirically investigated the impact of GHG emissions on financial performance (e.g. Delmas & Nairn-Birch, 2011; Boiral et al.,

2012; Wang et al., 2013). Thus, this study adds to the limited amount of research on firm performance and extends our knowledge about the impact of CMS adoption on financial performance as well as carbon performance.

Fifth, this study goes beyond the extant theoretical application, being the first study to have utilised the combination of RBV, legitimacy theory and stakeholder theory as the theoretical framework. Whilst some prior studies (e.g. Aragon-Correa et al., 2008; Murrillo-Luna et al., 2008; Clarkson et al., 2011b; Cowan & Deegan, 2011; Cotter & Najah, 2012; Hrasky, 2012) have tested these theories in the context of carbon disclosure, none have used them in the specific context of CMS adoption. As organisations and their identities are arguably socially constructed, they are mostly driven by the environment in which the organisation operates, legitimised organisational activities, and the strategies adopted to manage stakeholder relationships. Thus, it is argued that a multifaceted theoretical framework provides greater insights than any single theoretical lens.

Sixth, accounting literature offering guidance for managers to develop effective carbon strategies for their businesses is still relatively limited (Hoffman & Woody, 2008). In Australian context, common themes appearing in the literature are mainly focusing on carbon footprints and legitimisation strategies (Hrasky, 2012), carbon reporting (Simnett & Nugent, 2007; Rankin et al., 2011; Solomon, Solomon, Norton & Joseph, 2011; Haigh & Shapiro, 2011; Haque & Islam, 2015) and carbon accounting (Bebbington & Larrinaga-Gonzalez, 2008; Bowen & Wittneben, 2011; Ascui & Lovell, 2011). However, empirical research exploring various carbon management activities to deal with climate change and related carbon emissions are still scarce. No prior study examines this relationship in a setting where carbon emissions disclosure regulation is significantly increasing (like NGER Act). It appears to be the first to provide direct Australian evidence on drivers of corporate CMS adoption and its impact on firm performance.

Finally, the sample size was relatively large compared with the datasets used in prior studies. Weinhofer and Hoffmann (2010) conceptualised a company's carbon strategy based on 91 electricity producers; in another study, Jeswani et al. (2008) examined the key factors influencing corporate adoption of GHG reduction strategy based on a survey of 180 companies. These studies were cross-sectional, while this study was longitudinal based on sophisticated regression analysis. More importantly, unlike other

studies which have focused on carbon/GHG reduction strategy, this study has examined the drivers and impact of CMS adoption in an Australian context. Using a sample of ASX 200 firms across a five-year period, this study has conducted a more systematic and comprehensive evaluation; hence, substantially increasing the power of the analysis.

## 9.5 RESEARCH IMPLICATIONS

This thesis is important to firms, policy makers and users as it provides an understanding of the drivers and impact of CMS adoption, which are useful for dealing with climate change. The findings of this thesis have implications for firms, public-policy makers and users.

This thesis provides relevant insights for firms in repositioning themselves to improve their environmental accountability and corporate image. A firm's management can use the results of this research to better comprehend the potential benefits of mitigating carbon emissions. The process of seeking ways to mitigate carbon emissions can represent, in itself, a source of increased competitiveness, in addition to the environmental and social benefits that may result. This can result in gaining competitive advantage by developing dynamic capabilities and obtaining valuable, rare, inimitable, and non-substitutable resources. Firms can engage in emissions trading, improve processes and products, and establish organisational structures for climate change, in order to gain valuable resources and capabilities that link to their sustained competitive advantage.

Empirical evidence shows that the presence of EMS and environmental committee increase the likelihood of CMS adoption. The findings should be useful for public-policy makers who are concerned with the impact of governance structure on emissions-control targets. Given the findings about the internal organisational factors of CMS adoption, policy makers should look more into possible ways to improve the corporate governance practices in terms of carbon emissions management.

The findings from this study also assist various stakeholders such as investors, competitors, suppliers and consumers. It provides insights on the general trends in CMS adoption among Australian companies who are likely to be leaders in the areas of carbon emissions reduction, stakeholder communication and corporate governance.

## 9.6 LIMITATIONS

Although this study is one of the few that has investigated drivers of corporate CMS adoption and its impact on firm performance, it still has some limitations – limitations that mostly represent opportunities for further research. First, the findings are based on the top 200 Australian-listed firms, which may limit the generalisability of the results to other jurisdictions such as small- or medium-sized firms or those operating in other nations.

Second, although considerable efforts were made to choose appropriate proxies after consulting the relevant literature, data constraints may have limited the construct validity of some of the variables. In addition, it is important to acknowledge the inherent limitations of positivistic empirical research to capture the complexity of numerous dimensions influencing CMS adoption decisions. For example, this study used the two most common board structure variables – size and independence – consistent with prior literature. Other potentially critical factors that have not been explored include CEO duality, female directors, and directors with multiple appointments (board business). In terms of stakeholder pressure, the study used the proxies for regulators, employees, institutional investors, media and ENGOs. Due to the unavailability of relevant data, suppliers, customers and competitors were not used as a measure of stakeholder pressure.

Third, this study has only used publicly-available corporate disclosures from annual reports, sustainability reports, company websites, newspaper articles and CDP surveys. Hence, the study had to assume that the reported information was truly reflective of actual actions and intent among the firms.

Finally, panel data are used for all the empirical analyses. One of the major limitations of panel data with respect to the relationship between drivers of corporate CMS adoption and firm performance, is that this type of data considers differences within a firm and does not consider the differences between observations (Zhou, 2001).

## 9.7 FURTHER RESEARCH

A number of possible future research directions are offered in this section in relation to the findings presented from this investigation. First, future research could examine climate change information and related CMS adoption from more direct and

alternative sources. Qualitative research using primary source of data is suggested to further explore the underlying internal motivations and management practices of specific companies proactively addressing climate change issues. Furthermore, in terms of research methods outside of the content analysis used here, interviews could be conducted to collect first-hand information from managers and external stakeholders. Sourcing a range of interviewees will ensure varied views and information about climate change and CMS adoption are taken into consideration. This approach would then provide a more comprehensive view of CMS adoption status. Richer insights could be gained from case studies or survey-based research of firms adopting CMS.

Second, numerous scholars and practitioners have called for more studies in different contexts on the relationship between environmental strategies and firm performance (e.g. Clemens & Bakstran, 2010). The relationship seems to be contextual. In certain situations, environmental strategies may be more important as certain industries are more sensitive to public scrutiny. For example, the pharmaceutical industry is more sensitive to public awareness of environmental consciousness than the steel industry. In addition, certain customers are more environmentally aware than others. For example, Western European consumers seem more environmentally-conscious than those in most of the developing countries, which may be due to different priorities (see for example Elijido-Ten, Kloot and Clarkson, 2010). In relation to CMS adoption, only a few studies (Jeswani et al., 2008) have addressed carbon management activities in the developing country context; thus, research is needed to better understand corporate carbon strategies in different contexts (e.g. developing mega-markets such as China and India).

## 9.8 CHAPTER SUMMARY

This chapter has provided a conclusive overview of the main findings from the two phases of this research. It has also discussed contributions and possible research implications stemming from this study. In addition, it has acknowledged the limitations of this study and put forward further research opportunities.

This study has presented some unique and robust results in relation to CMS adoption by organisations. CMS adoption is commonly viewed as an attempt by managers to legitimise a firm's activities to the community. In the context of climate change, firms experience a considerable degree of stakeholder pressure to account for their carbon

impact. Firms therefore adopt different types of CMS in an attempt to actively manage the changing norms and expectations of various stakeholder pressures. Furthermore, CMS adoption is considered as a strategic resource which enhance both financial and carbon performance. Thus, the development of organisational capability via CMS adoption often leads to a sustainable competitive advantage.

Overall, this study provides empirical evidence of the associations between CMS adoption, stakeholder pressure, and financial and carbon performance in an Australian context. As such, it has raised a range of new concepts and possibilities for extending extant literature on CMS adoption and its impact on firm performance, given the growing challenges faced by firms in terms of climate change and related carbon emissions. This study is therefore both timely and warranted.

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# APPENDICES

## APPENDIX A

### Table A.1: Logistic regression results – internal drivers of CMS adoption (Interaction between firm size and environmentally-sensitive industry)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | CMS | | | |
| Constant | C | | -11.025 | **0.001*** ** |
| Independent variables: | EMS | + | 1.075 | **0.001*** ** |
| | ECOM | + | 0.933 | **0.001*** ** |
| | BSIZE | + | 0.012 | 0.835 |
| | BIND | + | 1.711 | **0.003*** ** |
| Control variables: | FAGE | + | 0.001 | 0.781 |
| | FSIZE | + | 0.500 | **0.001*** ** |
| | LEV | + | 1.024 | **0.043** ** |
| | INDY | + | -6.225 | **0.029** ** |
| Interaction variable | INDY* FSIZE | + | 0.276 | **0.040** ** |
| Year dummies | | | Included | |
| *Pseudo $R^2$ = 0.3107* | *Wald Chi-square = 238.91 (0.001)* | | *Total observation = 894* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMS = carbon management strategy is a dichotomous variable that equals 1 if a firm adopts CMS, and otherwise 0; EMS = environmental management system is a dichotomous variable that equals 1 if a firm implements an EMS, and otherwise 0; ECOM = environmental committee is a dichotomous variable that equals 1 if a firm has an environmental committee, and otherwise 0; BSIZE = board size is the number of directors on board; BIND = board independence is the number of independent directors scaled by the size of the board; FAGE = firm age is the number of years since the firm's incorporation; FSIZE = firm size is the natural logarithm of the firm's revenue; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

# APPENDIX A (cont.)

## Table A.2: Ordered probit regression results – internal drivers of CMS adoption (Alternative measure of CMS adoption)

| | | | Outcome 1: Compensation strategy | | Outcome 2: Reduction strategy | | Outcome 3: All-rounder strategy | |
|---|---|---|---|---|---|---|---|---|
| | | **Expected sign** | **Marginal effects** | **Probability** | **Marginal effects** | **Probability** | **Marginal effects** | **Probability** |
| Dependent variable: | CMS | | | | | | | |
| Independent variables: | EMS | + | -0.0022 | 0.111 | 0.0540 | **0.013**** | 0.0557 | **0.010**** |
| | ECOM | + | -0.0019 | 0.132 | 0.0459 | **0.046**** | 0.0474 | **0.025**** |
| | BSIZE | + | -0.0005 | 0.103 | 0.0140 | **0.014**** | 0.0144 | **0.007***** |
| | BIND | + | -0.0069 | 0.123 | 0.1650 | **0.012**** | 0.1704 | **0.016**** |
| Control variables: | FAGE | + | -0.0002 | 0.689 | 0.0050 | 0.685 | 0.0052 | 0.683 |
| | FSIZE | + | -0.0006 | 0.102 | 0.0149 | **0.002***** | 0.0154 | **0.004***** |
| | LEV | + | -0.0054 | 0.103 | 0.1302 | **0.003***** | 0.1344 | **0.002***** |
| | INDY | + | 0.0009 | 0.337 | -0.0220 | 0.274 | -0.0227 | 0.275 |
| Year dummies | | | Included | | Included | | Included | |
| | | | *Pseudo $R^2$ = 0.1560* | | *Wald Chi-square = 108.53 (0.001)* | | *Total Observation = 894* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMS = carbon management strategy is an ordered categorical variable that equals 0 if a company does not adopt any CMS, equals 1 if a company adopts compensation strategy, equals 2 if it adopts reduction strategy, and equals 3 if it adopts all-rounder strategy; EMS = environmental management system is a dichotomous variable that equals 1 if a firm implements an EMS, and otherwise 0; ECOM = environmental committee is a dichotomous variable that equals 1 if a firm has an environmental committee, and otherwise 0; BSIZE = board size is the number of directors on the board; BIND = board independence is the number of independent directors scaled by the size of the board; FAGE = firm age is the number of years since the firm's incorporation; FSIZE = firm size is the natural logarithm of the firm's revenue; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

# APPENDIX A (cont.)

## Table A.3: Logistic regression results – internal drivers of CMS adoption (Random effect)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | CMS | | | |
| Constant | C | | -0.358 | **0.046**** |
| Independent variables: | EMS | + | 0.199 | **0.001***** |
| | ECOM | + | 0.106 | **0.029**** |
| | BSIZE | + | 0.009 | 0.307 |
| | BIND | + | 0.359 | **0.018**** |
| Control variables: | FAGE | + | 0.041 | 0.217 |
| | FSIZE | + | 0.027 | **0.003***** |
| | LEV | + | 0.183 | 0.129 |
| | INDY | + | -0.070 | **0.025**** |
| Year dummies | | | Included | |
| *Adjusted $R^2$ = 0.2188* | *Wald Chi-square = 124.13 (0.001)* | | *Total Observation = 894* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMS = carbon management strategy is a dichotomous variable that equals 1 if a firm adopts CMS, and otherwise 0; EMS = environmental management system is a dichotomous variable that equals 1 if a firm implements an EMS, and otherwise 0; ECOM = environmental committee is a dichotomous variable that equals 1 if a firm has an environmental committee, and otherwise 0; BSIZE = board size is the number of directors on the board; BIND = board independence is the number of independent directors scaled by the size of the board; FAGE = firm age is the number of years since the firm's incorporation; FSIZE = firm size is the natural logarithm of the firm's revenue; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

# APPENDIX A (cont.)

## Table A.4: Logistic regression results – internal drivers of CMS adoption (Industry effect)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | CMS | | | |
| Constant: | C | | -7.505 | **0.001*** ** |
| Independent variables: | EMS | + | 1.174 | **0.001*** ** |
| | ECOM | + | 0.976 | **0.002*** ** |
| | BSIZE | + | 0.216 | **0.001** ** |
| | BIND | + | 2.215 | **0.001** ** |
| Control variables: | FAGE | + | 0.157 | 0.140 |
| | FSIZE | + | 0.240 | **0.001*** ** |
| | LEV | + | 1.874 | **0.001** ** |
| Industry dummies[a]: | COND | - | -0.568 | 0.263 |
| | CONS | - | -0.895 | 0.204 |
| | ENG | + | -0.150 | 0.795 |
| | FIN | - | 0.560 | 0.287 |
| | HCR | + | -1.408 | **0.016** ** |
| | INDS | + | -0.957 | **0.061** * |
| | IT | + | -0.827 | 0.243 |
| | MAT | + | -0.904 | **0.083** * |
| | TELS | + | -1.044 | 0.116 |
| Year dummies | | | Included | |
| *Pseudo* $R^2$ = 0.2663 | *Wald Chi-square = 183.83 (0.001)* | *Correctly classified = 80.36%* | *Total observation = 894* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMS = carbon management strategy is a dichotomous variable that equals 1 if a firm adopts CMS, and otherwise 0; EMS = environmental management system is a dichotomous variable that equals 1 if a firm implements an EMS, and otherwise 0; ECOM = environmental committee is a dichotomous variable that equals 1 if a firm has an environmental committee, and otherwise 0; BSIZE = board size is the number of directors on the board; BIND = board independence is the number of independent directors scaled by the size of the board; FAGE = firm age is the number of years since the firm's incorporation; FSIZE = firm size is the natural logarithm of the firm's revenue; LEV = leverage is the ratio of total debt to total assets at the end of fiscal year; COND = consumer discretionary industry; CONS = consumer staples industry; ENG = energy industry; FIN = financials industry; HCR = health care industry; INDS = industrials industry; IT = information technology industry; MAT = material industry; TELS = telecommunication services industry.
[a]Omitted industry is utilities.

# APPENDIX A (cont.)

## Table A.5: Logistic regression results – internal drivers of CMS adoption (Alternative measure of control variable)

| | | | **Model 1** | | **Model 2** | |
|---|---|---|---|---|---|---|
| | | *Expected sign* | *Coefficient* | *Probability* | *Coefficient* | *Probability* |
| Dependent variable: | CMS | | | | | |
| Constant: | C | | -15.243 | **0.001*** ** | -17.553 | **0.001*** ** |
| Independent variables: | EMS | + | 1.079 | **0.002*** ** | 1.249 | **0.001*** ** |
| | ECOM | + | 0.886 | **0.036** ** | 1.032 | **0.014** ** |
| | BSIZE | + | 0.018 | 0.858 | 0.082 | 0.386 |
| | BIND | + | 1.664 | **0.076*** | 2.514 | **0.004*** ** |
| Control variables: | FAGE | + | -0.062 | 0.743 | -0.038 | 0.837 |
| | FSIZE (TA) | + | 0.704 | **0.001*** ** | | |
| | FSIZE (MCAP) | + | | | 0.754 | **0.001*** ** |
| | LEV | + | 0.994 | 0.186 | 2.299 | **0.003*** ** |
| | INDY | + | -0.310 | 0.349 | -0.612 | **0.058*** |
| Year dummies | | | Included | | Included | |
| *Pseudo $R^2$* | | | 0.3087 | | 0.3017 | |
| *Wald Chi-square* | | | 126.53 | | 138.05 | |
| *Correctly classified* | | | 79.19% | | 78.72% | |
| *Total observation* | | | 894 | | 894 | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMS = carbon management strategy is a dichotomous variable that equals 1 if a firm adopts CMS, and otherwise 0; EMS = environmental management system is a dichotomous variable that equals 1 if a firm implements an EMS, and otherwise 0; ECOM = environmental committee is a dichotomous variable that equals 1 if a firm has an environmental committee, and otherwise 0; BSIZE = board size is the number of directors on the board; BIND = board independence is the number of independent directors scaled by the size of the board; FAGE = firm age is the number of years since the firm's incorporation; FSIZE = firm size is the natural logarithm of the firm's total asset (model 1); FSIZE = firm size is the natural logarithm of the firm's market capitalisation (model 2); LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

# APPENDIX B

## Table B.1: Ordered probit regression results – stakeholder pressure and CMS adoption

### (Random effect)

| | | Expected sign | Model 1 | | Model 2 | |
|---|---|---|---|---|---|---|
| | | | **Coefficient** | **Probability** | **Coefficient** | **Probability** |
| Dependent variable: | CMS | | | | | |
| Independent variable: | REG | + | -0.050 | 0.560 | 0.019 | 0.624 |
| | EMP | + | 0.005 | 0.979 | 0.003 | 0.782 |
| | INS | + | 0.006 | **0.021**** | 0.003 | **0.034**** |
| | MDA | + | 0.007 | **0.029**** | 0.001 | **0.089*** |
| | ENGO | + | 0.562 | **0.001***** | 0.078 | 0.334 |
| Control variables: | FSIZE | + | 0.298 | **0.001***** | 0.251 | **0.001***** |
| | LEV | + | 0.565 | **0.011**** | 0.378 | **0.081*** |
| | INDY | + | 0.057 | 0.540 | 0.030 | 0.653 |
| Year dummies | | | Included | | Included | |
| *Model Chi-square* | | | *266.34* | | *166.60* | |
| *Pseudo $R^2$* | | | *0.1659* | | *0.2520* | |
| *Total observation* | | | *850* | | *850* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; REG = regulation is a binary variable that equals 1 if a company is required to report GHG/carbon emissions under *NGER Act 2007*, and otherwise 0; EMP = employee is the natural logarithm of the number of employees in a company; INS = institutional investor is the percentage of shares owned by institutional investors in a particular company; MDA = media is the total number of articles that include a statement about the company and its environmental issues; ENGO = environmental non-government organisation is a binary variable that equals 1 if any article portrays the company's environmental practices in a negative light, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's total asset; LEV = leverage is the ratio of total debt to total assets at the end of fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

# APPENDIX B (cont.)

## Table B.2: Ordered probit regression results – stakeholder pressure and CMS adoption (Industry effect)

| | | Outcome 1: | | | Outcome 2: | | | Outcome 3: | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Compensation strategy | | | Reduction strategy | | | All-rounder strategy | | |
| | | Expected sign | Marginal effects | Probability | Expected sign | Marginal effects | Probability | Expected sign | Marginal effects | Probability |
| Dependent variable: | CMS | | | | | | | | | |
| Independent variables: | REG | + | 0.00012 | 0.730 | - | -0.00569 | 0.729 | - | -0.00353 | 0.729 |
| | EMP | - | 0.00001 | 0.840 | + | -0.00086 | 0.840 | + | -0.00053 | 0.840 |
| | INS | - | -0.00002 | **0.069*** | + | 0.00122 | **0.023**** | + | 0.00075 | **0.027**** |
| | MDA | - | -0.00002 | **0.088*** | + | 0.00131 | **0.045**** | + | 0.00081 | **0.036**** |
| | ENGO | - | -0.00212 | **0.027**** | + | 0.09853 | **0.003***** | + | 0.06122 | **0.002***** |
| Control variables: | FSIZE | + | -0.00125 | **0.003***** | + | 0.05797 | **0.001***** | + | 0.03602 | **0.001***** |
| | LEV | + | -0.00203 | **0.085*** | + | 0.09443 | **0.036**** | + | 0.05867 | **0.040**** |
| Industry dummies[a]: | COND | - | 0.00176 | 0.103 | - | -0.08156 | **0.059*** | - | -0.05067 | **0.061*** |
| | CONS | - | 0.00117 | 0.332 | - | -0.05444 | 0.310 | - | -0.03382 | 0.310 |
| | ENG | + | 0.00092 | 0.370 | + | -0.04293 | 0.352 | + | -0.02667 | 0.353 |
| | FIN | - | 0.00147 | 0.147 | - | -0.06849 | 0.103 | - | 0.04256 | 0.108 |
| | HCR | + | 0.00317 | **0.037**** | + | -0.14696 | **0.005***** | + | 0.09131 | **0.007***** |
| | INDS | + | 0.00098 | 0.297 | + | -0.04552 | 0.272 | + | -0.02828 | 0.273 |
| | IT | + | 0.00036 | 0.816 | + | -0.01696 | 0.816 | + | -0.01054 | 0.816 |
| | MAT | + | 0.00113 | 0.239 | + | -0.05275 | 0.206 | + | -0.03278 | 0.209 |
| | TELS | + | 0.00187 | 0.317 | + | -0.08688 | 0.291 | + | -0.05398 | 0.292 |
| Year dummies | | | Included | | | Included | | | Included | |
| | | *Pseudo $R^2$ = 0.1724* | | | *Chi-square = 276.86 (0.001)* | | | *Total Observation = 850* | | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMST = carbon management strategy type is an ordered categorical variable that equals 0 if a company does not adopt any CMS, equals 1 if a company adopts compensation strategy, equals 2 if it adopts reduction strategy, and equals 3 if it adopts all-rounder strategy; REG = regulation is a binary variable that equals 1 if a company is required to report GHG/carbon emissions under *NGER Act 2007*, and otherwise 0; EMP = employee is the natural logarithm of the number of employees in a company; INS = institutional investor is the percentage of shares owned by institutional investors in a particular company; MDA = media is the total number of articles that include a statement about the company and its environmental issues; ENGO = environmental non-government organisation is a binary variable that equals 1 if any article portrays the company's environmental practices in a negative light, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's total asset; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; COND = consumer discretionary industry; CONS = consumer staples industry; ENG = energy industry; FIN = financials industry; HCR = health care industry; INDS = industrials industry; IT = information technology industry; MAT = material industry; TELS = telecommunication services industry.

[a]Omitted industry is utilities.

# APPENDIX B (cont.)

## Table B.3: Ordered probit regression results – stakeholder pressure and CMS adoption

## (Alternative measure of control variable)

| | | Outcome 1: | | | Outcome 2: | | | Outcome 3: | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Compensation strategy | | | Reduction strategy | | | All-rounder strategy | | |
| | | **Expected sign** | **Marginal effects** | **Probability** | **Expected sign** | **Marginal effects** | **Probability** | **Expected sign** | **Marginal effects** | **Probability** |
| Dependent variable: | CMST | | | | | | | | | |
| Independent variables: | REG | + | 0.00033 | 0.527 | - | -0.01024 | 0.519 | - | -0.00734 | 0.519 |
| | EMP | - | 0.00005 | 0.668 | + | -0.00180 | 0.665 | + | -0.00129 | 0.665 |
| | INS | - | -0.00003 | **0.060*** | + | 0.00122 | **0.020**** | + | 0.00087 | **0.023**** |
| | MDA | - | -0.00006 | **0.026**** | + | 0.00187 | **0.003***** | + | 0.00133 | **0.001***** |
| | ENGO | - | -0.00486 | **0.008***** | + | 0.15011 | **0.001***** | + | 0.10751 | **0.001***** |
| Control variables: | FSIZE | + | -0.00083 | **0.004***** | + | 0.02581 | **0.001***** | + | 0.01848 | **0.001***** |
| | LEV | + | -0.00491 | **0.016**** | + | 0.15159 | **0.001***** | + | 0.10858 | **0.001***** |
| | INDY | + | 0.00074 | 0.195 | + | -0.02287 | 0.157 | + | -0.01638 | 0.158 |
| Year dummies | | | Included | | | Included | | | Included | |
| | | *Pseudo $R^2$ = 0.1301* | | | *Chi-square = 195.41 (0.001)* | | | *Total observation = 850* | | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMST is an ordered categorical variable that equals 0 if a company does not adopt any CMS, equals 1 if a company adopts compensation strategy, equals 2 if it adopts reduction strategy, and equals 3 if it adopts all-rounder strategy; REG = regulation is a binary variable that equals 1 if a company is required to report GHG/carbon emissions under *NGER Act 2007*, and otherwise 0; EMP = employee is the natural logarithm of the number of employees in a company; INS = institutional investor is the percentage of shares owned by institutional investors in a particular company; MDA = media is the total number of articles that include a statement about the company and its environmental issues; ENGO = environmental non-government organisation is a binary variable that equals 1 if any article portrays the company's environmental practices in a negative light, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's revenue; LEV = leverage is the ratio of total debt to total assets at the end of fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

# APPENDIX B (cont.)

## Table B.4: Ordered probit regression results – stakeholder pressure and CMS adoption

## (Alternative measure of control variable)

| | | Outcome 1: | | | Outcome 2: | | | Outcome 3: | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Compensation strategy | | | Reduction strategy | | | All-rounder strategy | | |
| | | **Expected sign** | **Marginal effects** | **Probability** | **Expected sign** | **Marginal effects** | **Probability** | **Expected sign** | **Marginal effects** | **Probability** |
| Dependent variable: | CMST | | | | | | | | | |
| Independent variables: | REG | + | 0.00042 | 0.245 | - | -0.02159 | 0.207 | - | -0.01317 | 0.207 |
| | EMP | - | 0.00001 | 0.907 | + | -0.00052 | 0.907 | + | -0.00031 | 0.907 |
| | INS | - | -0.00002 | **0.091*** | + | 0.00117 | **0.037**** | + | 0.00071 | **0.043**** |
| | MDA | - | -0.00003 | **0.055*** | + | 0.00175 | **0.013**** | + | 0.00107 | **0.009***** |
| | ENGO | - | -0.00238 | **0.021**** | + | 0.11987 | **0.001***** | + | 0.07312 | **0.001***** |
| Control variables: | FSIZE | + | -0.00117 | **0.006***** | + | 0.05890 | **0.001***** | + | 0.03593 | **0.001***** |
| | LEV | + | -0.00409 | **0.014**** | + | 0.20566 | **0.001***** | + | 0.12546 | **0.001***** |
| | INDY | + | 0.00063 | 0.123 | + | -0.03173 | **0.069*** | + | -0.01935 | **0.073*** |
| Year dummies | | | Included | | | Included | | | Included | |
| | | *Pseudo $R^2$ = 0.1453* | | | *Chi-square = 227.95 (0.001)* | | | *Total observation = 850* | | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CMST is an ordered categorical variable that equals 0 if a company does not adopt any CMS, equals 1 if a company adopts compensation strategy, equals 2 if it adopts reduction strategy, and equals 3 if it adopts all-rounder strategy; REG = regulation is a binary variable that equals 1 if a company is required to report GHG/carbon emissions under *NGER Act 2007*, and otherwise 0; EMP = employee is the natural logarithm of the number of employees in a company; INS = institutional investor is the percentage of shares owned by institutional investors in a particular company; MDA = media is the total number of articles that include a statement about the company and its environmental issues; ENGO = environmental non-government organisation is a binary variable equals that 1 if any article portrays the company's environmental practices in a negative light, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's market capitalisation; LEV = leverage is the ratio of total debt to total assets at the end of fiscal year; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

# APPENDIX C

## Table C.1: Regression results – CMS adoption and financial performance (Alternative measure of financial performance)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | FPRF | | | |
| Constant: | | | 0.226 | **0.058*** |
| Independent variable: | CMS | + | 0.043 | **0.082*** |
| Control variables: | FSIZE | + | -0.005 | 0.330 |
| | LEV | + | 0.004 | 0.953 |
| | GRTH | + | 0.009 | 0.552 |
| | REG | + | 0.020 | 0.270 |
| | INDY | + | -0.058 | **0.001**** |
| Year dummies | | | Included | |
| *Adjusted* $R^2$= 0.021 | *F-statistic (10, 964) = 3.02 (0.001)* | | *Total observation = 919* | |
| *** significant at 1% level; ** significant at 5% level; *significant at 10% level. | | | | |

FPRF = financial performance is measured by ROE which is the ratio of net income and stakeholders' equity; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's total asset; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

# APPENDIX C (cont.)

## Table C.2: Regression results – CMS adoption and financial performance (Random effect)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | FPRF | | | |
| Constant: | | | 0.321 | **0.001*** ** |
| Independent variable: | CMS | + | 0.025 | **0.019** ** |
| Control variables: | FSIZE | + | -0.011 | **0.001*** ** |
| | LEV | + | -0.006 | 0.787 |
| | GRTH | + | -0.009 | **0.001*** ** |
| | REG | + | 0.016 | **0.062*** |
| | INDY | + | -0.031 | **0.001*** ** |
| Year dummies | | | Included | |
| *Adjusted* $R^2$= 0.039 | *Wald Chi-square= 36.88 (0.001)* | | *Total observation = 919* | |
| *** significant at 1% level; ** significant at 5% level; *significant at 10% level. | | | | |

FPRF = financial performance is measured by ROA which is the ratio of income before interest and tax to total assets; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's total asset; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; INDY = industry is a dichotomous variable where a score of 1 is awarded to firms belonging to an environmentally-sensitive industry (e.g. energy, utilities, industrials, health care, information technology, telecommunication services and materials), and otherwise 0.

# APPENDIX C (cont.)

## Table C.3: Regression results – CMS adoption and financial performance (Industry effect)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | FPRF | | | |
| Constant: | C | | 0.307 | **0.008*** ** |
| Independent variable: | CMS | + | 0.029 | **0.013** ** |
| Control variables: | FSIZE | + | -0.008 | 0.106 |
| | LEV | + | -0.029 | 0.300 |
| | GRTH | + | -0.007 | 0.255 |
| | REG | + | 0.011 | 0.193 |
| Industry dummies[a]: | COND | | 0.009 | 0.505 |
| | CONS | | -0.051 | **0.001** ** |
| | ENG | | -0.133 | **0.001*** ** |
| | FIN | | -0.066 | **0.001*** ** |
| | HCR | | 0.007 | 0.0.979 |
| | INDS | | 0.062 | **0.001*** ** |
| | IT | | 0.157 | **0.001*** ** |
| | MAT | | -0.089 | **0.001*** ** |
| | UTL | | -0.095 | **0.001*** ** |
| Year dummies | | | Included | 0.561 |
| *Adjusted* $R^2$= 0.1553 | *F-statistic (18, 900) = 14.83 (0.001* | | *Total observation = 919* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

FPRF = financial performance is measured by ROA which is the ratio of income before interest and tax to total assets; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FSIZE = firm size is the natural logarithm of the firm's total asset; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; COND = consumer discretionary industry; CONS = consumer staples industry; ENG = energy industry; FIN = financials industry; HCR = health care industry; INDS = industrials industry; IT = information technology industry; MAT = material industry; UTL = utilities industry.

[a]Omitted industry is telecommunication services.

# APPENDIX C (cont.)

## Table C.4: Regression results – CMS adoption and carbon performance (Alternative measure of carbon performance)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | CPRF | | | |
| Constant | C | | -16.893 | **0.001*** ** |
| Independent variable: | *CMS* | + | 0.931 | **0.028** ** |
| Control variables: | *FPRF* | + | 0.219 | 0.932 |
| | *FSIZE* | + | 0.543 | **0.001*** ** |
| | *LEV* | + | 1.417 | 0.158 |
| | *GRTH* | - | -0.034 | **0.005*** ** |
| | *REG* | + | 0.099 | 0.708 |
| Year dummies | | | Included | |
| *Adjusted $R^2$ = 0.2097* | *F-statistic (10, 352) = 5.77 (0.001)* | | *Total observation = 517* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CPRF = carbon performance is the inverse of carbon intensity which is measured as tons of carbon emissions per AUD$1 million of sales revenue; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FPRF = financial performance is measured by ROA which is the ratio of income before interest and tax to total assets; FSIZE = firm size is the natural logarithm of the firm's total asset; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0.

# APPENDIX C (cont.)

## Table C.5: Regression results – CMS adoption and carbon performance (Alternative measure of financial performance)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | CPRF | | | |
| Constant | C | | -12.302 | **0.001*** ** |
| Independent variable: | *CMS* | + | 0.484 | **0.075*** |
| Control variables: | *FPRF* | + | 1.246 | **0.099*** |
| | *FSIZE* | + | 0.312 | **0.001*** ** |
| | *LEV* | + | 0.710 | 0.277 |
| | *GRTH* | - | -0.034 | **0.001*** ** |
| | *REG* | + | -0.066 | 0.734 |
| Year dummies | | | Included | |
| *Adjusted $R^2$ = 0.1505* | *F-statistic (10, 505) = 5.14 (0.001)* | | *Total observation = 517* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CPRF = carbon performance is the inverse of carbon intensity which is measured as tons of carbon emissions per AUD$1 million of sales revenue; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FPRF = financial performance is measured by ROE which is the ratio of net income and stakeholders' equity; FSIZE = firm size is the natural logarithm of the firm's total asset; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0.

# APPENDIX C (cont.)

## Table C.6: Regression results – CMS adoption and carbon performance (Random effect)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | CPRF | | | |
| Constant | C | | -12.583 | **0.001*** ** |
| Independent variable: | *CMS* | + | 0.463 | **0.093*** |
| Control variables: | *FPRF* | + | 2.516 | **0.036**** |
| | *FSIZE* | + | 0.320 | **0.001*** ** |
| | *LEV* | + | 0.985 | **0.085*** |
| | *GRTH* | - | -0.034 | **0.001*** ** |
| | *REG* | + | -0.084 | 0.660 |
| Year dummies | | | Included | |
| *Adjusted $R^2$ = 0.1487* | *Wald Chi-square= 88.42 (0.001)* | | *Total observation = 517* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CPRF = carbon performance is the inverse of carbon intensity which is measured as tons of carbon emissions per AUD$1 million of sales revenue; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FPRF = financial performance is measured by ROA which is the ratio of income before interest and tax to total assets; FSIZE = firm size is the natural logarithm of the firm's total asset; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0.

# APPENDIX C (cont.)

## Table C.7: Regression results – CMS adoption and carbon performance (Industry effect)

| Model 1 | | *Expected sign* | *Coefficient* | *Probability* |
|---|---|---|---|---|
| Dependent variable: | CPRF | | | |
| Constant: | C | | -10.266 | **0.001*** ** |
| Independent variable: | CMS | + | 0.573 | **0.021** ** |
| Control variables: | FPRF | + | 2.550 | **0.030** ** |
| | FSIZE | + | 0.239 | **0.001*** ** |
| | LEV | + | -0.293 | 0.605 |
| | GRTH | - | -0.027 | **0.001*** ** |
| | REG | + | -0.066 | 0.704 |
| Industry dummies[a]: | COND | | 0.792 | **0.051*** |
| | CONS | | 0.041 | 0.906 |
| | ENG | | -2.554 | **0.001** ** |
| | FIN | | 0.483 | 0.194 |
| | HCR | | 0.262 | 0.505 |
| | INDS | | 0.001 | 0.997 |
| | MAT | | -1.403 | **0.001*** ** |
| | UTL | | -1.401 | **0.008*** ** |
| Year dummies | | | Included | |
| *Adjusted* $R^2$= 0.3564 | *F-statistic (18, 498) = 19.26 (0.001)* | | *Total observation = 517* | |

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.

CPRF = carbon performance is the inverse of carbon intensity which is measured as tons of carbon emissions per AUD$1 million of sales revenue; CMS = carbon management strategy is a dichotomous variable that equals 1 if a company adopts CMS, and otherwise 0; FPRF = financial performance is measured by ROA which is the ratio of income before interest and tax to total assets; FSIZE = firm size is the natural logarithm of the firm's total asset; LEV = leverage is the ratio of total debt to total assets at the end of the fiscal year; GRTH = growth is the change in sales divided by prior year sales; REG = regulation is a binary variable that equals 1 if a company is required to report carbon emissions under *NGER Act 2007*, and otherwise 0; COND = consumer discretionary industry; CONS = consumer staples industry; ENG = energy industry; FIN = financials industry; HCR = health care industry; INDS = industrials industry; IT = information technology industry; MAT = material industry; TEL = telecommunication services industry; UTL = utilities industry.
[a]Omitted industry is information technology.