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Voluntary Greenhouse Gas Emissions Reporting in Australia: A framework for analysis

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Abstract

Australia's *National Greenhouse and Energy Reporting Act 2007* (NGER Act 2007) establishes a mandatory framework for corporate reporting of greenhouse gas (GHG) emissions. However, not all businesses meet the NGER's mandatory reporting threshold. Ninety-five per cent of listed companies are estimated to fall outside the scope of the legislation. This thesis investigates how corporations outside the ambit of the NGER Act 2007 meet their GHG reporting obligations. It examines the extent to which a framework can be developed to achieve a trade-off between its mandatory and voluntary GHG reporting practices. The thesis undertakes a systematic review of 62 peer-reviewed articles from 2008 to 2016 relating to voluntary GHG reporting practice in Australia, and a content analysis of 2013 annual reports, sustainability reports and Carbon Disclosure Project (CDP) reports from four Australian listed companies and two local government councils. The analysis reveals that the voluntary GHG reporting practices of entities (corporate and local government) that are not subject to the NGER regime lack consistency, comparability and transparency. California's voluntary GHG reporting regime is then contrasted with Australia's. Under its cap-and-trade regulation, California has developed a robust voluntary GHG reporting program within a framework that requires local governments and organisations to design a consistent assessment mechanism to keep track of their GHG emission allowances. The results make it clear that formal emissions reporting regimes foster a systematic and improved voluntary GHG disclosure culture. The thesis concludes by suggesting that for Australia to achieve verifiable emissions reductions in line with its international commitments, the way forward is to adopt a framework akin to California's voluntary GHG reporting under mandatory legislation.

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Statement of Candidate

I certify this thesis entitled ‘Voluntary Greenhouse Gas Emissions Reporting in Australia: A framework for analysis’ is an original research work that has been written by me. This thesis has not been previously submitted for a degree at any university or institution other than Macquarie University. I have also acknowledged any assistance received in my preparation of research thesis. Further, I certify that all literature and information source used in this thesis are referenced properly.

Rong Qing Bao

03 September 2017

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List of Acronyms

AAAJ	Accounting, Auditing & Accountability Journal
AB 32	Assembly Bill 32
ABDC	Australian Business Deans Council
AFBI	Australian Food and Beverage Industry
ANZ	Australia and New Zealand Banking Group
ARB	Air Resources Board
ASX	Australian Securities Exchange
CCAR	California Climate Action Registry
CDP	Carbon Disclosure Project
CDSB	Climate Disclosure Standards Board
CEC	Corporate Environment Committee
CEO	Chief Executive Officer
CGQ	Corporate Governance Quality
CMPs	Carbon Management Practices
CMS	Carbon Management Strategy
CMSs	Carbon Management Systems
EMSs	Environmental Management Systems
ETS	Emissions Trading Scheme
EU	European Union
GHG	Greenhouse Gas
GRI	Global Reporting Initiatives
IASB	International Accounting Standards Board
IND	Individualism
ISAE	International Standard on Assurance Engagements
LTO	Long-term Orientation
MAS	Masculinity
MTOB	Market to Book
NGER	National Greenhouse and Energy Reporting
NPI	National Pollutant Inventory
PD	Power Distance
ROA	Return on Assets
ROE	Return on Equity
RRM	Reputation Risk Management
TCR	The Climate Registry
UA	Uncertain Avoidance
US	United States
VEPs	Voluntary Environmental Programs

1. Introduction

Australia is one of the largest greenhouse gas (GHG) emitters in the world, despite its small population (Gosnell, 2017); it also has mandatory and voluntary GHG reporting regimes. In 2007, the Australian government introduced the *National Greenhouse and Energy Reporting Act 2007* (NGER Act 2007) to create a mandatory framework for corporate reporting of GHG emissions. According to this framework, companies must provide GHG reporting when their GHG emissions exceed a certain threshold. However, not all businesses reach the NGER mandatory reporting threshold—an estimated 95% of Australian listed companies fell outside the scope of the NGER Act 2007 in 2016, and these are described as ‘non-registered companies’. Based on data provided by the Australian Securities Exchange (ASX),¹ the Australian Government Clean Energy Regulator (2017) and the Carbon Disclosure Project (CDP, 2016a), approximately 27% of non-registered ASX 200 companies (e.g., Bendigo and Adelaide Bank Limited, Alumina Limited) report their emissions on a voluntary basis.

Possible reasons why non-registered companies have taken the trouble to register include the fact that both financial (e.g., investors, creditors) and non-financial (e.g., public, political, employees) stakeholders increasingly demand GHG information to make better decisions in relation to health and future living environments (e.g., Cowan & Deegan, 2011; Guenther, Guenther, Schiemann, & Weber, 2016; Haque & Islam, 2015). To meet various stakeholders’ expectations, companies voluntarily provide GHG reporting to enhance their reputation, transparency, competitive advantage and legitimacy (e.g., Alrazi, De Villiers, & Van Staden, 2016; Luo & Tang, 2016; Mudd, 2010; Sutantoputra, Lindorff, & Johnson, 2012). Therefore, voluntary GHG reporting has garnered significant attention from businesses and researchers.

Voluntary GHG reporting has been increasing in Australia since 2008, when the country ratified the Kyoto Protocol. Generally, the frameworks for voluntary GHG reporting in Australia sit within internal architectures, and include the CDP, the Global Reporting Initiative (GRI) or the Climate Disclosure Standards Board (CDSB) Framework. Companies must strike a balance between economic profits and environmental issues to manage the risks posed by climate change. Meanwhile, by using different research approaches, researchers have identified dramatic differences in the cognition, extent, quality and adoption of voluntary GHG reporting by various Australian companies (e.g., Haigh, 2008; Haque & Deegan, 2010; Newell,

¹ <https://www.asx200list.com/>

Jenner, & Baker, 2009; Simnett, Nugent, & Huggins, 2009). In spite of the growing prominence of GHG reporting in Australia, there has been no systematic academic review identifying themes and trends in the approaches to voluntary GHG reporting.

Most Australian research on voluntary GHG reporting to date has adopted a quantitative approach. The focus has been on factors such as corporate governance, firm size, industry characteristics, culture or regulations that affect the cognition, extent, quality and adoption of voluntary GHG reporting (e.g., Amran, Periasamy, & Zulkafli, 2014; Ben-Amar & McIlkenny, 2015; Luo & Tang, 2015; Oates & Moradi-Motlagh, 2016). Further, based on the internal scales of management (nation, project, product and organisation), Stechemesser and Guenther (2012) perform a review of carbon accounting literature concerning the concept of carbon accounting, but excluded voluntary GHG reporting that addresses external scales. Zuo and Zhao (2014) conduct a systematic review of research associated with Australian green buildings. Although they addressed the overall topic of sustainability reporting, their research does not generate any insight into voluntary GHG reporting in Australia. To date, researchers have seldom analysed existing articles related to voluntary GHG reporting, particularly in the Australian context.

From a theoretical perspective, while linking the value of voluntary GHG reporting to accounting research, most previous studies have concentrated on providing explanations for incentives to facilitate voluntary GHG reporting. Typically, previous studies have applied a variety of theories through a piecemeal approach, such as considering one, two, three or four incentives in isolation (Clarkson, Overell, & Chapple, 2011; Hogan & Lodhia, 2011; Ortas, Gallego-Álvarez, & Álvarez Etxeberria, 2015; Trotman & Trotman, 2015). The result is a lack of an overall theoretical framework for understanding the incentives and drivers for voluntary GHG reporting.

Although various studies have attempted to review GHG reporting in Australia, they are of limited value for three reasons. Some studies (Burritt, 2012; Linnenluecke, Birt, & Griffiths, 2015) are limited to a few journal articles; others (Linnenluecke et al., 2015; Siew, 2015) do not disclose and demonstrate a rigid method of review; and one (Burritt, 2012) mainly focuses on a single issue, accountability of environmental performance, by reviewing articles within *Accounting, Auditing & Accountability Journal* (AAAJ). Siew (2015) provides an overview of the methodology and criteria set out in the framework for reporting GHG emissions, but does not disclose and demonstrate a rigid method of review.

The research focus of this thesis differs from that of earlier works in that it uses a systematic review to investigate voluntary GHG reporting research in Australia from 2008, when Australia ratified the Kyoto Protocol (to be replaced by the Paris Agreement in 2020²), to the present. A systematic literature review builds an overall picture or framework using up-to-date information to demonstrate the current research landscape—in this case, that of voluntary GHG reporting in Australia. This portrait of previous research will not only provide accounting researchers, various stakeholders and policymakers with a better understanding of the perspectives of voluntary GHG reporting, but may also assist Australian organisations, especially non-registered companies and those in the public sector, in decisions on reporting, managing and analysing the relevant risks and opportunities posed by climate change.

Based on a systematic review of 62 articles over a nine-year period (from 2008 to 2016), this research proposes a framework, based on the analysis of existing literature and Australian entities' GHG reporting practices, that aims to explain and facilitate improvements to voluntary GHG reporting in the Australian context. In particular, the interactive Input-Process-Output model (Pavitt, 2014) is used to evaluate and interpret the 62 articles, targeting their different perspectives, relationships, consistencies, inconsistencies, gaps, central themes and future trends. Then a content analysis of 2013 annual reports, sustainability reports and CDP reports of a sample of four Australian companies and two local government councils is conducted to demonstrate the systematic review findings. Subsequently, the Californian voluntary GHG reporting program (The Climate Registry [TCR], 2013) is used as a framework to analyse voluntary GHG reporting in Australia. The framework developed from Californian GHG reporting regimes illustrates the extent to which a framework can achieve a trade-off between mandatory GHG reporting and voluntary GHG reporting to improve voluntary GHG disclosure. This thesis contributes to existing research by providing a comprehensive understanding of the nature and state of voluntary GHG reporting in Australia. The specific contributions are as follows. This study narrows the scope of sustainability reporting by concentrating on one specific aspect (voluntary GHG reporting). Existing literature is reviewed to identify the overall relationships and trends. Based on this review, the study offers detailed insights into

² The first commitment of the Kyoto Protocol expired in 2012 and its second commitment (the Doha Amendment) started in January 2013. The Doha Amendment will run until December 2020. It is unlikely to be enacted before 2020 because most parties are focused on the Paris Agreement, which came into force in November 2016 (http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1617/Quick_Guides/QG-DohaAmendment).

possible theories that explain the incentives for voluntary GHG reporting. Through categorising the literature, the study identifies research themes as well as gaps and underexposed themes. It also contributes to existing literature on voluntary GHG reporting in Australia by providing an overview of the GHG reporting practices of four major Australian companies and two local government councils. Finally, applying a collaborative framework—California’s voluntary GHG reporting program under mandatory legislation—to analyse voluntary GHG reporting in Australia offers rich insights into the debate on mandatory GHG reporting versus voluntary GHG reporting.

The rest of the thesis is structured as follows: Section 2 explores the prior research on voluntary GHG reporting. Section 3 outlines the research methods. Section 4 explores the findings of the systematic literature review and discusses the research gaps, central themes and future research agenda for voluntary GHG reporting. Section 5 presents and discusses the Australian GHG reporting evidence from four listed companies and two local governments to demonstrate and support the literature review findings. Section 6 suggests a framework developed from Californian GHG reporting regimes to analyse voluntary GHG reporting in Australia. Section 7 summarises the main findings and presents the research implications and limitations.

2. Research background

This section explores the history and the nature of voluntary GHG reporting in Australia. It begins with the GHG reporting classifications, which primarily represent the four types of GHG reporting in practice. It then provides an overview of how voluntary GHG reporting has developed in Australia, the primary forms of Australian voluntary GHG reporting and the significant research conducted into voluntary GHG reporting in Australia.

2.1 Classifying GHG reporting

Global warming, as a world problem, is clearly related to enterprises’ GHG emissions (Peters et al., 2013). Therefore, enterprises, as significant contributors to climate change, must take responsibility for their emissions and strengthen environmental management (Haque & Deegan, 2010). This requires an enterprise’s accounting systems to be integrated with environmental activities, including the disclosure of GHG emissions and energy consumption.

Meanwhile, climate change has significant effects on the economy, society and the environment through events such as flooding, drought and heatwaves (Commonwealth Scientific and Industrial Research Organisation, 2015). In the face of this growing

environmental problem, many countries across the world recognise the need for GHG reporting. Thus, from the Kyoto Protocol, adopted in 1997, to the Bonn-Marrakesh Agreement, held in 2001 (Den Elzen & De Moor, 2002), GHG reporting has emerged as an increasingly important issue.

Four different types of GHG reporting are identified in practice—these include mandatory GHG reporting, GHG reporting relating to emissions trading schemes (ETs), voluntary disclosure schemes and voluntary organisational disclosures (Simnett et al., 2009). These reporting frameworks have been adopted as follows. The California Air Resources Board (ARB) (2014) implemented the *Global Warming Solutions Act of 2006* (also called Assembly Bill [AB] 32), which established a GHG reporting program enforcing that larger emitters should report GHG emissions from January 2008. In addition, Australia established the National Pollutant Inventory (NPI) in 1998, which is underpinned by a legislative framework, mandating businesses meeting certain criteria to provide annual NPI reports reflecting their emissions level (Australian Government Business, 2016). Further to this, Australia enacted the NGER Act 2007, which, since 1 July 2008, requires large companies (registered companies) to report their GHG emissions, measured in carbon dioxide equivalence (CO₂-e), when their GHG, energy consumption or production exceeds certain thresholds (Australian Government Clean Energy Regulator, 2016).

The ETS was designed as a reporting mechanism to facilitate the trade in excess GHG emissions and assist high emitters in meeting reporting requirements. ETS systems include the mandatory European Union (EU) ETS that commenced in January 2005, the mandatory New Zealand ETS enforced in July 2010, three bills on the Australian Carbon Pollution Reduction Scheme proposed in May 2009 (failed in August 2009), October 2009 (failed in December 2009) and February 2010 (lapsed in September 2010³) and the Australian Carbon Pricing Mechanism that commenced in July 2012 (repealed in July 2014) (Rankin, Stanton, McGowan, Ferlauto, & Tilling, 2012). California's cap-and-trade regulation came into force in January 2013.⁴

Organisations can voluntarily disclose GHG emissions through voluntary disclosure schemes, such as the CDP, the GRI, the voluntary Japanese ETS or the California Climate Action

³ http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Browse_by_Topic/ClimateChangeold/governance/domestic/national/cprs

⁴ The California cap-and-trade program designed by the ARB delivers cost-effective GHG emission mitigations and ranks second in the world after ETS (<https://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>).

Registry (CCAR) (Simnett et al., 2009). In addition, many organisations voluntarily disclose GHG emissions to achieve better reputations as good corporate citizens by promoting their outstanding environmental performance (Clarkson, Li, Richardson, & Vasvari, 2008). Organisations also adopt other forms of voluntary organisational disclosure of GHG emissions, such as sustainability reports, separate annual report sections or single environmental reports (Rankin et al., 2012).

2.2 The development of voluntary GHG reporting in Australia

To mitigate climate change by constraining GHG emissions, the Kyoto Protocol (first commitment period) came into force in February 2005 and expired in 2012 (United Nations Framework Convention on Climate Change, 1998). According to the United Nations Framework Convention on Climate Change (2014), 192 countries have ratified the Kyoto Protocol, including Australia in December 2007. Following the adoption of the second commitment of the Kyoto Protocol (the Doha Amendment), which runs from 2013 to 2020, the Paris Agreement came into force on 4 November 2016 and attained 160 party ratifications.⁵ On 10 November 2016, Australia ratified the second commitment of the Kyoto Protocol and the Paris Agreement to achieve 2020 and 2030 GHG emissions mitigation targets (Turnbull, Bishop, & Frydenberg, 2016). Under the Kyoto Protocol, some countries have developed ETS to achieve a national GHG emissions reduction target, resulting in the need for GHG reporting. In response to the need, some countries enacted their GHG reporting regulations, such as the Australian NGER Act 2007 and the *Canadian Environmental Protection Act 1999* (Rankin et al., 2012).

The Australian Government Department of Environment and Energy (2016) defines and classifies GHG emissions to help companies to collect and report them. These definitions include Scope 1 GHG emissions (those directly emitted by businesses), Scope 2 GHG emissions (indirect emissions generated by consumed and purchased electricity) and Scope 3 GHG emissions (which expand the scope of accounting to cover indirect emissions from purchasing various goods and services). Although Downie and Stubbs (2012) argue that Scope 3 GHG emissions contribute the largest percentage of total emissions for most companies, the

⁵ http://unfccc.int/paris_agreement/items/9485.php

NGER Act 2007's reporting threshold is 50 kilotons CO₂-e of combined Scope 1 and Scope 2 GHG emissions, yet excludes Scope 3 GHG emissions.⁶

However, Boesso (2002) argues that voluntary reporting should be at the discretion of managers rather than required by authoritative accounting standards or legislation. Kim and Lyon (2011) suggest that voluntary reporting presents a sense of 'selection effects' in which companies have a choice in what to report. Moreover, Borghei and Leung (2013) indicate that GHG reporting is not voluntary if firms have to disclose GHG emissions to comply with an accounting standard, such as carbon financial risks under contingent liabilities, or to satisfy ETS requirements. In addition, some researchers indicate that ETS is a regulatory scheme aimed at placing pressure on firms to provide GHG reporting (Olson, 2010; Tang & Luo, 2016). Therefore, voluntary GHG reporting tends to be defined as GHG information disclosed by companies at their management's discretion rather than companies complying with legislation, ETS or authoritative accounting standards.

2.3 The forms of voluntary GHG reporting in Australia

Clarkson et al. (2011) indicate that most Australian environmental reporting is voluntary. The CDP, the world-famous voluntary disclosure scheme, is adopted in Australia for reducing GHG emissions and mitigating risks presented by climate change. Based on a set of questionnaires, the CDP requires organisations to measure their environmental effects for responding to investor requests. According to the CDP and CDSB (2016), five Australian cities (Sydney, Canberra, Melbourne, Perth and Adelaide) reported over 1.67 billion metric tonnes of GHG emissions through the CDP's city program in 2015, while over 800 institutional investors increasingly require greater transparency in terms of how companies manage climate change risks. In response to this, approximately 400 Australian companies, including ASX-listed companies, have provided GHG reports through CDP programs. In fact, through the CDP's consistent central mission and growing stakeholder concerns about climate change, Sydney was highlighted as a climate leader in 2016.⁷ Some Australian companies (e.g., Australia and New Zealand Banking Group [ANZ]) have made significant progress in addressing climate change and environmental issues (CDP, 2016b).

⁶ <http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/What-data-is-published-and-why>

⁷ Sydney is a member of the C40 Cities Climate Leadership Group. It was rewarded with InFocus Reports for performing leadership on climate change in 2016 (<https://www.cdp.net/ja/reports/downloads/1778>).

Another voluntary reporting scheme widely used in Australia is the GRI. Compared with the CDP, which focuses on environmental effects (e.g., energy and GHG emissions), the GRI provides companies with main performance indicators and a framework of principles for how to disclose social, economic and environmental performance, such as climate change issues related to GHG emissions, energy consumption and GHG mitigation (Cotter, Najah, & Wang, 2011; Rankin et al., 2012). The GRI is also treated as a suitable form for investors by the Australian Council of Superannuation Investors because it has worldwide support and comparability across domestic and international firms (GRI, 2014).

To encourage standardisation and assist organisations in providing consistent and concise GHG information to investors, the CDSB Framework has been developed, which combines the CDP and GRI.⁸ Cotter et al. (2011) state that the CDSB Framework aims to enhance climate change and environmental reporting by establishing organisational boundaries that use a consolidated approach in current mainstream reporting. The CDSB Framework not only focuses on a way for organisations to report environmental issues and natural capital in annual reports or integrated reports, but also aligns with regulatory reporting requirements (CDSB, 2017b). Moreover, the CDSB Framework was developed as a voluntary reporting framework to provide investors with detailed information on climate change effects (CDSB, 2017a). In Australia, the CDSB Framework has been referred to in the ASX Corporate Governance Principles and Recommendations (CDP & CDSB, 2016).

2.4 The significance of voluntary GHG reporting in Australia

Borghei, Leung and Guthrie (2016) indicate the importance of understanding the nature of voluntary GHG reporting protocols adopted by non-registered companies, as a significant number of ASX-listed companies are in this category. For reasons mentioned earlier, some non-registered companies have opted to provide GHG data on a voluntary basis despite the absence of a requirement to do so under an international accounting standard (Borghei et al., 2016). Based on the data provided by the Australian Government Clean Energy Regulator (2017) and the ASX (2016), Figure 1 presents the number of non-registered listed companies—2,079 out of a possible 2,189 ASX-listed companies—that accounts for 95% of listed

⁸ The CDSB Framework aims to add value to organisations' mainstream reports by connecting their environmental issues (<http://www.cdsb.net/what-we-do/reporting-frameworks/environmental-information-natural-capital>).

companies. The voluntary GHG reporting protocols have contributed to both accounting theories (Clarkson et al., 2008) and practices (Haque & Deegan, 2010) as follows.

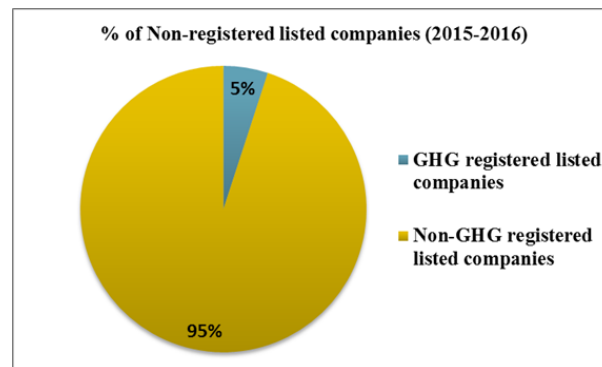


Figure 1: Data for non-registered companies in Australia

Voluntary GHG reporting has theoretical significance because it simulates the development of accounting theories. By incorporating environmental issues into accounting systems, GHG reporting extends the accounting research field and expands the economic responsibility of traditional financial accounting to include environmental accountability (Schaltegger & Csutora, 2012; Stechemesser & Guenther, 2012). Voluntary GHG reporting also broadens the accounting research field in Australia because elements of GHG disclosure, such as regulation, institution, technology and emotion, tend to inform people's cognition of climate change-based accounting research (Milne & Grubnic, 2011). Meanwhile, according to Prado-Lorenzo and García-Sánchez (2010), voluntary GHG reporting extends the economics field, because GHG disclosure with improper environmental behaviour may cause economic damage. Further, Rankin et al. (2012) argue that the diversity of measures and guidance on how to account for emissions trading activities or GHG pollution permits prevents voluntary GHG reporting in Australia from being comparable. Therefore, Lodhia and Jacobs (2013) argue that researchers should go beyond the standard theoretical scope and adopt various theoretical perspectives to explain GHG disclosure. Ortas et al. (2015) conclude that developing a framework of multiple theories for GHG reporting would lead to a better understanding of responses and incentives for companies responding to various levels of influence.

Voluntary GHG reporting has practical significance in Australia because climate change is a business imperative and affects companies' profitability. The social and economic activities linked to the causes and effects of climate change have become critical sustainable development issues for businesses (Schaltegger & Csutora, 2012). Moreover, because of

increased public awareness of environmental protection, companies are obliged to strengthen their environmental management. Stechemesser and Guenther (2012) suggest that companies should consider environmental issues when pursuing economic profits, as this promotes corporate social responsibility by balancing environmental issues and economic benefits. Notably, researching voluntary GHG reporting may assist stakeholders in making effective strategic decisions (Schaltegger & Csutora, 2012). It also helps evaluate the accountability of company strategies for managing climate change risks, including regulatory risks (e.g., growing compliance costs), physical risks (e.g., water shortage, business disruptions, increased insurance costs) and other risks (e.g., changes in consumer attitudes and needs or loss of reputation) (Haque & Deegan, 2010). In October 2016, these climate change risks were pronounced to be included in a director's duty of care by Australian regulatory, businesses and investment leaders (e.g., Australian Securities and Investments Commission, Qantas and ANZ).⁹ Voluntary GHG reporting builds companies' competitive advantage in a carbon-constrained world (Luo & Tang, 2016), and allows companies to mitigate GHG emissions and help the environment. According to Haque and Deegan (2010), various stakeholders are increasingly demanding that GHG reporting in practice be adopted.

3. Research method

This research was conducted in four stages. Stage 1 adopted a process model of reviewing existing literature to identify broad themes before moving to the specific methodology. Stage 2 involved a systematic literature review suggested by Fink (2014). In Stage 3, an additional content analysis was conducted of the annual reports, sustainability reports and CDP reports of four Australian listed companies and two local government councils to demonstrate the findings of the systematic literature review in Stage 2. In Stage 4, the Californian voluntary GHG reporting program was used as a framework to analyse voluntary GHG reporting in Australia.

3.1 Research scope of voluntary GHG reporting in Australia

The central aspects of the voluntary GHG reporting process are similar to those used in financial reporting—both processes include cognition, planning, collection, interpretation and disclosure of information (Hahn, Reimsbach, & Schiemann, 2015). Pavitt's (2014) interactive

⁹ <http://aicd.companydirectors.com.au/advocacy/governance-leadership-centre/external-environment/climatechange-and-directors-duties>

Input-Process-Output model, integrating the central aspects, was selected and modified to understand voluntary GHG reporting decisions. Companies implement their cognitions of voluntary GHG reporting (Input) in planning a response. The response can be establishing a climate change policy to prepare GHG reports and meet societal expectations (Process), then influencing various stakeholders' cognitions of the company through GHG disclosure (Output). The model was modified by adding 'Outcome', which implies further activities within companies and society by linking to financial performance, corporate environmental performance and stakeholders' decisions. Therefore, the modified Input-Process-Output-Outcome model (see Figure 2) likely provides the most comprehensive tool to demonstrate the process of voluntary GHG reporting.

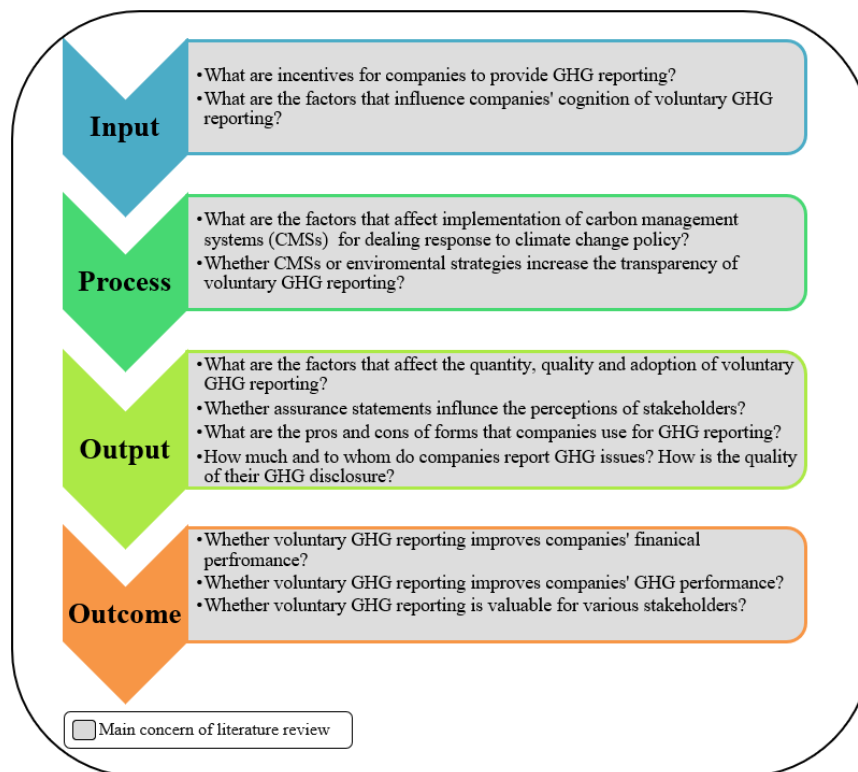


Figure 2: A model for analysing voluntary GHG reporting

Figure 2's four aspects and main research areas are explained as follows. 'Input' refers to a company's cognition. Motivation promotes a company's activities in understanding GHG reporting. Moreover, some factors, such as culture, regulation or economy, tend to influence a company's cognition of voluntary GHG reporting. 'Process' comprises a company's planning and preparation. Companies are likely to formulate strategies and develop management systems relating to environmental issues, such as Carbon Management Systems (CMSs), to

deal with preparing, collecting and interpreting GHG information. ‘Output’ is the GHG reporting produced. Some factors, such as firm size, corporate governance or leverage, are likely to influence companies’ decisions on the extent, quality and adoption of the GHG reporting. Some companies voluntarily embed assurance statements within GHG reporting for increasing reliability. Voluntary GHG reporting can be made available to the public through sustainability reports, sections of annual reports, CDP reports or corporate websites, which appear to change stakeholders’ cognition of companies’ environmental performance (Rankin et al., 2012). Stakeholders’ decisions rely on the detailed and credible GHG information that companies disclose. ‘Outcome’ covers implications, changes in financial and GHG performance, helpfulness to stakeholder decision-making and the further actions of businesses and society.

3.2 A systematic literature review

Fink (2014, p. 3) states that ‘a research literature review is a systematic, explicit and reproducible’ methodology used to identify, evaluate and synthesise the existing body of previous studies. This research uses the approach of a structured and systematic literature review, as recommended by Fink, to investigate the different perspectives, relationships, gaps and future trends relating to voluntary GHG reporting in the Australian context.

The research question is defined at the outset. The current state of voluntary GHG reporting in the Australian context is explored using existing literature. The different perspectives, major gaps, relations, consistencies, inconsistencies, issues requiring further investigation, central themes and direction for future research are identified by analysing the review findings. This research used five online databases that are most widely employed for searching various journals: Business Source Premier, Emerald Management, ScienceDirect, Sage Journals Online and Wiley Online Library. The Business Source Premier, for instance, is a very efficient and effective database that is widely used and incorporated into a larger information system developed by Elton Bryson Stephens Company (Oulanov, 2008). In addition, to broaden the journal coverage, Google Scholar was also used as a supplementary database.

Different sets of keywords were created and used to obtain the extensive range of articles, such as ‘voluntary GHG disclosure Australia’, ‘voluntary GHG reporting Australia’, ‘voluntary greenhouse disclosure Australia’, ‘voluntary greenhouse reporting Australia’, ‘voluntary carbon disclosure Australia’ and ‘voluntary carbon reporting Australia’. Keywords such as

‘voluntary GHG reporting’, ‘voluntary greenhouse reporting’, ‘voluntary GHG disclosure’ and ‘voluntary greenhouse disclosure’ were also used to avoid excluding researchers who adopted a global context that included Australian companies. Therefore, the search results were broadened rather than limited to specific disciplines, such as accounting, management or finance.

In addition to the keywords, practical screening criteria were developed and used for including or excluding articles from the systematic literature review. For this study, peer-reviewed (also known as scholarly) articles that had been published worldwide and written in English were included as potential research papers. The starting year was set as 2008 because Australia ratified the first commitment of the Kyoto Protocol at the end of 2007. Thus, only articles published between 2008 and 2016 were selected. In fact, during those nine years, researchers demonstrated different perspectives for investigating voluntary GHG reporting in the Australian context. At the beginning of 2017, there were 132 peer-reviewed journal articles resulting from this approach. To ensure the reliability and validity of these articles (Fink, 2014), they were ranked as A and A* by the Australian Business Deans Council (ABDC, 2016) journal list and/or ranked as Q1 and Q2 by Scimago Journal & Country Rank (SJR, 2016). The journals without ranking by ABDC were excluded, because this study focuses on high-quality research in the Australian context.

Following this selection process, 77 articles remained. These were then carefully checked before reviewing. Based on this screening process, 62 articles related to voluntary GHG reporting in the Australian context were finally selected and coded using NVivo 11. They are listed in Appendix 1 with their respective rankings. Methodological quality screening criteria were used to analyse the content of all 62 articles. Mayring’s (2000, 2015) systematic and qualitative-interpretative content analysis model was applied, and descriptive analysis was undertaken for each of the 62 articles identified, as suggested by Hahn et al. (2015). Structural categories were identified, and became the primary topics and titles for this research. Based on the structural categories, all articles were scrutinised thoroughly. Central themes were identified, and all study findings were interpreted and synthesised descriptively (Fink, 2014) (see section 4). Multiple interplays analysis was also applied to critically interpret the data, explore search patterns and refine all categories from the literature review (Hahn et al., 2015).

3.3 A content analysis to demonstrate systematic review findings

To provide evidence for demonstrating the Stage 2 findings, this section of the study analyses the GHG disclosure practices of four ASX 200 companies and two Sydney local government councils in 2013. To broaden the sample scope, the Financial, Material and Public sectors were selected. In addition, the sample included both registered and non-registered companies, because registered companies also participate in voluntary GHG reporting schemes (e.g., the CDP). The chosen local government councils are in Sydney because Sydney is one of five Australian cities participating in the CDP's city program. The four companies are ANZ (Registered, Financial), Bendigo and Adelaide Bank Limited (Non-registered, Financial), Rio Tinto Limited (Registered, Material) and Alumina Limited (Non-registered, Material). The two local government councils were City of Sydney Council (Public) and Blacktown City Council (Public). Annual reports and sustainability reports were captured from corporate and local government council websites, while the CDP reports were sourced from the CDP website (see Appendix 2). The 2013 annual reports and sustainability reports were based on GRI G3 indicators that are consistent with the data resources of the reviewed literature. Those reports were used as GHG disclosure forms for this part of the research because they represent the typical voluntary GHG reporting format (Rankin et al., 2012). Thus, whether differences exist between the annual reports, sustainability reports and CDP reports relating to GHG disclosure practices was also investigated.

Content analysis (Haque & Deegan, 2010) of annual reports, sustainability reports and CDP reports was performed to investigate GHG disclosure practices. However, a unit of analysis and categorisation must be clearly identified to create an effective content analysis (Haque & Deegan, 2010). Two approaches were used to capture data for the analysis: the number of disclosures and the extent of the disclosure (Gray, Kouhy, & Lavers, 1995a). This part of the study focuses on the number of GHG disclosures because it concentrates on the availability and lacking availability of GHG disclosures relating to typical GHG issues in 2013. If companies and local government councils disclosed such GHG issues, then a score of 1 was allocated; otherwise, the score was 0. The scores of the 2013 CDP reports are available from the CDP website.

Based on the documents addressing the CDP, GRI and NGER reporting requirements and the framework of Haque and Deegan's (2010) disclosure-scoring, a classified list of specific GHG disclosure relating to governance and operational practices was developed. While the CDP

scheme produces questionnaires and highlights policies and procedures to report Scope 1, Scope 2 and Scope 3 GHG emissions,¹⁰ the GRI and KPMG (2007) offer a framework for evaluating GHG disclosure in relation to governance policies that are expected to be disclosed in a sustainability report. The NGER Act 2007 develops reporting requirements for operational practices regarding GHG emissions.¹¹ These requirements are used to benchmark and then develop the GHG disclosure list, as the NGER Act incorporates voluntary GHG reporting relating to reduction, removal and offset of GHG emissions.¹² Therefore, in this study, by integrating the classified GHG disclosure list with Pavitt's (2014) Input-Process-Output model, a consolidated GHG disclosure list with governance GHG policies and operational GHG activities was created (see Appendix 3) to enable high-quality GHG disclosure (Maximum score 36). Lastly, the total of six annual reports, four sustainability reports and five CDP reports (see Appendix 2) were coded using NVivo 11.

3.4 A comparative analysis to suggest a way forward

Based on all the systematic literature review findings and the content analysis of four Australian companies and two local government councils, a comparative analysis of voluntary GHG reporting under the Californian jurisdiction was conducted as a framework for analysing voluntary GHG reporting in Australia. The Californian voluntary reporting program was selected because its GHG reporting framework incorporates TCR, an effective voluntary program for achieving active collaboration among governments, organisations and practitioners (Livingston, Lee, & Nguyen, 2015).

4. Interpreting and evaluating the systematic literature review

This section demonstrates and discusses the findings of a systematic review of the 62 peer-reviewed articles. Based on the Input-Process-Output-Outcome model (Pavitt, 2014), the results of interpreting and evaluating the reviewed articles fulfil this study's research objectives by identifying the different perspectives, relationships, consistencies, inconsistencies, major gaps, central themes and future trends.

¹⁰ <https://www.cdp.net/en/info/about-us>

¹¹ <https://www.legislation.gov.au/Details/C2017C00054>

¹² *National Greenhouse and Energy Reporting Act 2007* (Cth), s21 (1).

4.1 Descriptive analysis

Sixty-two peer-reviewed articles were selected from 33 different journals (see Appendix 1) and coded. The research areas from which these articles were sourced are accounting (16 journals), management (10 journals), economics (four journals), finance (two journals) and other commerce, management, tourism and services (one journal). This demonstrates that voluntary GHG reporting is of interest across a range of research disciplines.

4.1.1 Distribution over time

The overall trend, as illustrated in Figure 3, reveals a gradual growth over time in the number of related articles. This confirms the fact that voluntary GHG reporting in the Australian context is increasingly drawing researchers' curiosity. Following Australia ratifying the first commitment of the Kyoto Protocol at the end of 2007, the number of relevant publications significantly rose from 2008 to 2011. However, Figure 3 shows a decrease in publications from 2012 to 2013, which may be the result of a carbon tax being introduced in Australia in 2012 and abrogated in 2014.¹³ During that period, carbon pricing was regularly debated.¹⁴ There was another sharp increase from five publications in 2014 to 14 in 2016. This may be attributable to the growing interest in climate change during that period, in which various stakeholders exerted more expectations on companies to disclose GHG emissions and GHG emission mitigation strategies.

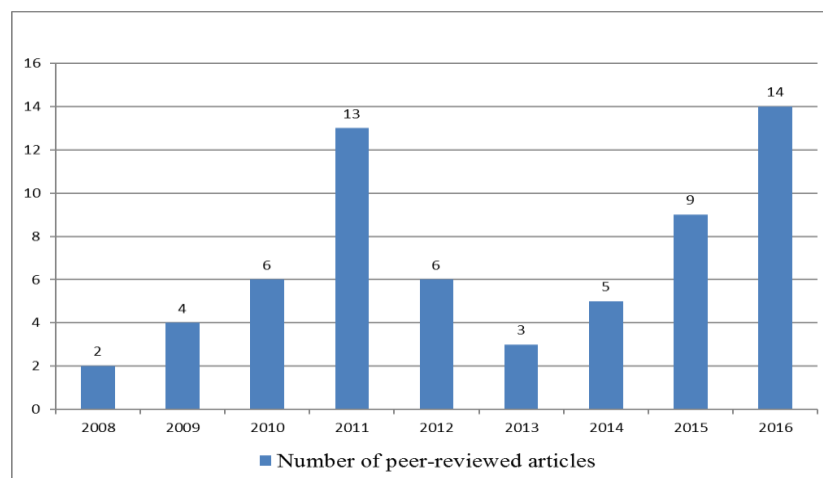


Figure 3: Peer-reviewed articles on voluntary GHG reporting published annually from 2008–2016

¹³ In 2011, the Gillard Labour Government introduced a carbon tax. It came into effect on 1 July 2012 and was then repealed by Abbott Government on 17 July 2014.

¹⁴ <http://www.theaustralian.com.au/opinion/carbon-debate-has-just-begun/news-story/7a12655fcf4d79c830aaa4da18a2e068>

4.1.2 A distribution based on the secondary data source

As researchers are likely to have collected data from existing documents to investigate voluntary GHG reporting for their publications from 2008 to 2016, this section examines the sources of the data relied upon for the research. The sources used include annual reports (31%), sustainability reports (29%), CDP reports (23%), corporate websites (12%) and others (5%) (see Figure 4). These data indicate that the three primary sources of voluntary organisational GHG reporting for research are annual reports, sustainability reports and CDP reports.

Figure 4 also shows a growing reliance on material sourced from the CDP reports in 2016. This trend is possibly explained by the fact that the CDP scheme not only possesses the largest collection of high-quality worldwide self-reported climate change and environmental risk information, and that various stakeholders base their investment decisions and mitigation risks on sustainability issues from this repository (CDP & CDSB, 2016). Since 2012, researchers have relied on CDP reports (18%) to a greater extent than on other sustainability reports (17%) and annual reports (16%). These figures demonstrate that sustainability reports may not be suitable for reporting GHG emissions and supporting the extent of GHG information investors now require, because they have a broader scope (Cotter et al., 2011). The figures are also consistent with Depoers, Jeanjean and Jérôme's (2016) argument that GHG information is merely a minor subset of annual reports compared with CDP reports and sustainability reports.

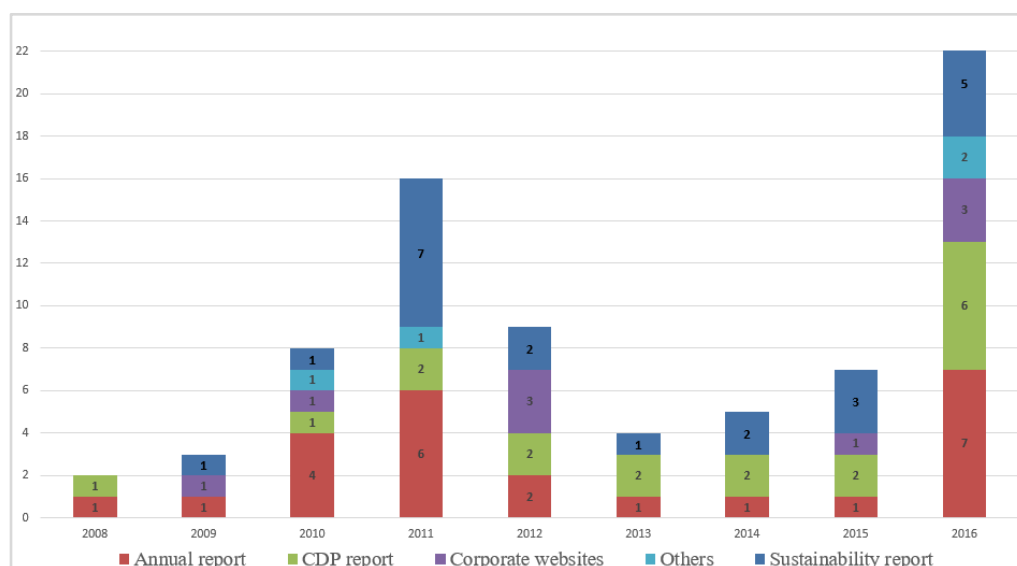


Figure 4: Secondary data source for voluntary GHG reporting research between 2008–2016

4.1.3 A distribution based on research method

Using the research methods outlined in section 3.2, the reviewed articles were categorised into two broad groups: quantitative and qualitative research (see Figure 5). Generally, the quantitative articles are based on modelling, quantitative content analysis, survey and experiment, whereas the qualitative articles contain commentary/normative studies, interviews, literature reviews, case studies and qualitative content analysis.

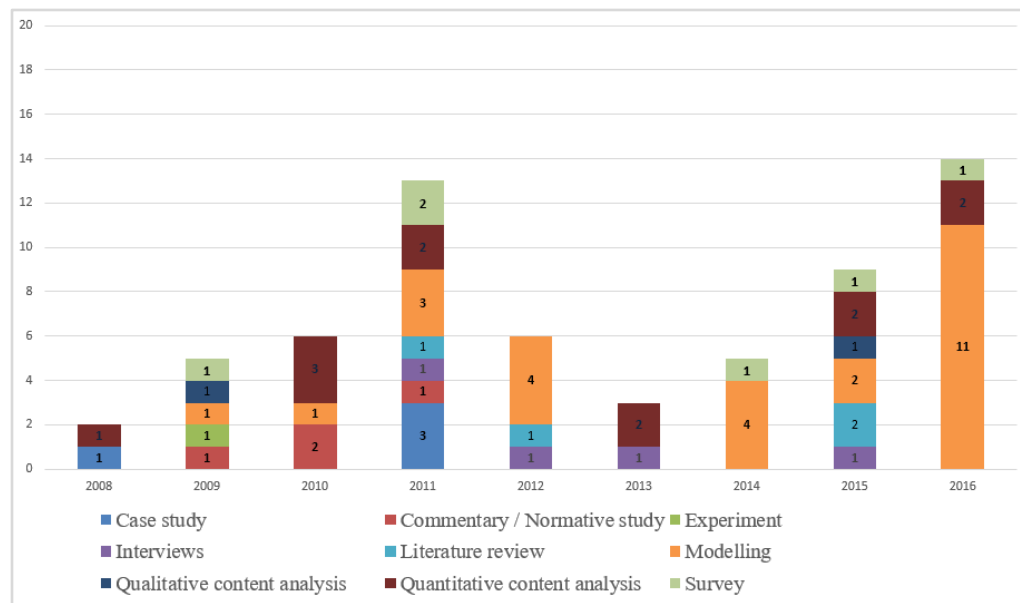


Figure 5: Research methods adopted in analysing voluntary GHG reporting between 2008–2016

Seventy-two per cent of the articles selected for this thesis apply a quantitative research methodology. Within this group of articles, approximately 41% use the regression model—a sharp increase in 2016 compared with 2008 to 2015. The remaining articles in this group adopt quantitative content analysis (19%), survey (10%) and experiment (2%). These figures indicate that researchers are more likely to examine voluntary GHG reporting using empirical datasets rather than obtaining views from different parties. The quantitative content analysis commonly used is facilitated by the rising availability of GHG information in annual reports, sustainability reports and CDP reports.

The remaining 28% of articles selected for this study adopt a qualitative approach in their analysis of voluntary GHG reporting in the Australian context. Notably, the researchers do not widely use qualitative methods to analyse voluntary GHG reporting. This situation suggests that researchers appear to ignore confirmatory and exploratory approaches that provide better insights into the underlying reasons, motivations and opinions behind voluntary GHG reporting.

4.2 Input

In response to climate change policies and relevant stakeholders, companies implement their input in planning their response. The input is the cognition that indicates how companies understand voluntary GHG reporting and act upon it. The remainder of this section reviews the selected studies in light of the theoretical drivers that motivate companies to understand and provide voluntary GHG disclosure, and the possible factors that influence companies' cognition, leading to the different performance levels of GHG disclosure.

4.2.1 Theoretical incentives for voluntary GHG reporting

The precepts of the voluntary disclosure theory (also called signalling theory) are that companies with outstanding environmental performance have significant motives to disclose their GHG information and thus differentiate themselves from companies with poor environmental performance (Verrecchia, 1983). Potentially, companies use objective environmental performance as a way to transfer positive information (Spence, 1973). A company may also want to ensure that its corporate environmental strategy is passed on to its stakeholders through environmental disclosure (Clarkson et al., 2008). Consistent with this theory, Cotter et al. (2011) indicate that companies are more inclined to disclose positive news on GHG matters in their sustainability reports. Studies (Gallego-Álvarez, 2012; Guenther et al., 2016) find that a superior GHG performer discloses more GHG information than a weak GHG performer. Luo and Tang (2014) conclude that outstanding GHG performers reveal more GHG information for distinguishing themselves from poor GHG performers, whereas companies with weak GHG performance tend to disclose less GHG information and send misleading information owing to litigation risks and higher reporting costs. Oates and Moradi-Motlagh (2016) reach the same conclusion in their study of local governments with good environmental performance.

The work of Clarkson et al. (2011) appears to deviate from the voluntary disclosure theory, as they find that Australian companies with outstanding environmental performance are less motivated to disclose environmental information and adopt objective or hard disclosure for differentiating themselves from companies with poor environmental performance. Kim and Lyon (2011) also present findings inconsistent with voluntary disclosure theory. They argue that GHG reporting via CDP questionnaires is not entirely voluntary, as companies are expected to disclose GHG information by investors, regulators and shareholders involved in

the CDP. If companies have an obligation to participate in the CDP, they tend to respond to it, regardless of their performance (Kim & Lyon, 2011). A later study by Sutantoputra et al. (2012) finds no evidence to support voluntary disclosure theory since, in their view, companies are more likely to select soft disclosure as a means of promoting general environmental awareness. Ortas et al. (2015) also do not support the voluntary disclosure theory and find that companies with high-level financial performance are unlikely to send a signal to stakeholders, because their financial performances are irrelevant to their GHG disclosure.

By contrast, socio-political theories (Gray, Kouhy, & Lavers, 1995b), such as stakeholder theory and legitimacy theory, point to a negative relationship between companies' environmental performance and voluntary GHG reporting, because companies that do not meet the expectations of a broader stakeholder group are more likely to voluntarily disclose their GHG information for fear that their legitimacy could be eroded. Prado-Lorenzo and García-Sánchez (2010) support the legitimacy and stakeholder theories by which companies tend to repair the legitimacy of their poor environmental practice. Clarkson et al. (2011) also agree with these socio-political theories, where companies with poor environmental performance are motivated to disclose more environmental information and focus on unverifiable or soft disclosure to alter stakeholder and public perceptions, rather than revealing their actual environmental performance. Further, consistent with these theories, Lokuwaduge and Heenetigala (2016) find that Australian mining firms are more inclined to disclose GHG information to reduce the pressure from primary stakeholders. Those firms make decisions on GHG disclosure because GHG reporting assists in reducing regulatory risks and maintaining the organisations' legitimacy in society.

From the perspective of stakeholder theory, the purpose of voluntary GHG reporting is to meet stakeholder expectations and gain stakeholder support (Roberts, 1992; Ullmann, 1985). Agreeing with this theory, Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Álvarez and García-Sánchez (2009) find that firms tend to benefit all stakeholders who are interested in receiving GHG emissions data. Sprengel and Busch (2011) assert that companies formulate strategies for reporting and reducing GHG emissions because they are obliged to respond to the overall collective pressure of all stakeholders. Cotter and Najah (2012) indicate that institutional investors, as legitimate and powerful stakeholders, substantially affect GHG reporting. Guenther et al. (2016) argue that it is necessary to consider both financial and non-

financial stakeholders when explaining GHG disclosure underpinned by stakeholder theory, because non-financial stakeholders are more likely to influence GHG disclosure directly.

Legitimacy theory (Suchman, 1995) has been widely used in previous studies to explain the motivation for voluntary GHG reporting. According to this theory, companies tend to legitimise their activities through voluntary disclosure of GHG information to minimise potential social pressure (Dowling & Pfeffer, 1975). Lindblom's (1994) four legitimacy strategies are frequently cited in the existing literature to analyse how companies shape their expectations of legitimacy, which includes enacting actual changes within their environmental performance and activities, attempting to alter public perception without making real changes, seeking to manipulate perceptions by deflecting public attention from major issues and trying to change external expectations related to companies' performance. Consistent with this theory, Prado-Lorenzo et al. (2009) propose that firms seek to legitimise their activities by responding to social, economic and political factors within the business context. Cuganesan, Guthrie and Ward (2010) link voluntary GHG reporting to implementing the type of legitimacy strategies by which companies within the Australian food and beverage industry (AFBI) are likely to engage in 'symbolic disclosures' because they are obliged to disclose GHG issues voluntarily. This voluntary disclosure may maintain credibility and legitimacy by seeking to change society's perceptions and expectations rather than changing company behaviour. Hrascky (2011) indicates that the reason an increasing number of companies voluntarily disclose environmental information relating to climate change and GHG emissions is to maintain their social contract and close a legitimacy gap between their environmental performance and stakeholder expectations. Hrascky's study also highlights that companies within less carbon-intensive sectors, such as finance, are likely to adopt symbolic impression management as a reporting strategy. This situation is consistent with pragmatic dispositional legitimacy, where companies engage in self-interested behaviour to gain support from stakeholders by portraying a positive image of themselves.

Cowan and Deegan (2011) find that Australian companies are more likely to voluntarily disclose GHG emissions to legitimise their business activities as a result of increased expectations from the public and stakeholders. Sciulli (2011) explains that senior managers of local government councils disclose sustainability issues such as GHG emissions to legitimise their actions. Two studies (Luo, Lan, & Tang, 2012; Ortas et al., 2015) conclude that companies are motivated to voluntarily disclose GHG information to legitimise their operations and

maintain their social contract because of social pressures. Sutantoputra et al. (2012) assert that Australian companies within environmentally sensitive industries, such as oil and gas, mining or chemical, voluntarily disclose more GHG information than other companies, since those companies with high pollution density are responding to high expectations of their environmental performance. Comyns and Figge (2015) state that firms can maintain legitimacy in society without enhancing the quality of their GHG reporting because ‘search’ information (e.g., be awarded) seems to be sufficient, which is consistent with legitimacy theory on the basis that the quality of voluntary GHG reporting is unlikely to be improved. Yunus, Eljido-Ten and Abhayawansa (2016) argue that large companies within environmentally sensitive industries have greater incentives to adopt CMSs to report GHG emissions in response to legitimacy threats.

Contrary to the legitimacy theory, Alrazi et al. (2016) conclude that GHG performance does not affect the level of GHG disclosure. They argue that both good and poor GHG performers are likely to disclose more GHG information because good performers attempt to differentiate themselves from poor performers, while poor performers tend to manage their reputation through putting ‘a positive spin’ (p. 667) on their situation.

Institutional theory deals with institutions’ social behaviour, including rule-based, symbolic or regulatory process (Cormier, Magnan, & Van Velthoven, 2005). Institutional theory indicates that organisational policies and practices are implemented in response to institutional and social pressure from powerful stakeholders to meet societal expectations and maintain and modify legitimacy within that society (DiMaggio & Powell, 1991). Consistent with this theory, Luo et al. (2012) find that companies provide voluntary GHG reporting in response to regulatory or institutional pressure to mitigate or avoid regulatory risks and compliance obligations. Haque and Islam (2015) indicate that organisations within Australia tend to voluntarily change their GHG disclosure practices as a consequence of stakeholder expectations for more environmental information in annual reports or on corporate websites. Trotman and Trotman (2015) state that companies tend to seek external assurance for GHG reporting to obtain external legitimacy. Luo and Tang (2016) argue that corporations often implement superior CMSs to manage GHG disclosure and respond to competitor pressure. According to Comyns (2016), although stakeholder theory and legitimacy theory are useful for considering voluntary GHG reporting, they have limited application, because GHG reporting analysis is undertaken from a company’s perspective. However, institutional theory overcomes

this limitation by extending the consideration externally to the multinational institutional environment, which is likely to prompt a further understanding of global GHG reporting practices.

According to agency theory, managers may take actions to satisfy their own interests rather than act in stakeholders' best interests, which results in higher agency costs (Jensen & Meckling, 1976). Traditionally, to maximise sales and minimise costs, management tends to avoid costs for dealing with environmental problems, such as undertaking activities to reduce GHG emissions, which will then represent a cost to shareholders, such as negative image and reputation. Therefore, agency theory assumes that companies will adopt different corporate governance mechanisms to maintain a professional reputation and reduce agency problems by aligning management and shareholder interests and monitoring management behaviour (Fama & Jensen, 1983). Agreeing with this theory, Ortas et al. (2015) conclude that firms with more debt have higher agency costs that motivate them to increase the extent of their GHG reporting. Jung, Herbohn and Clarkson (2016) find that companies are more likely to understand carbon risks and implement carbon risk strategies because the cost of debt increases if companies fail to demonstrate their carbon risk awareness by disclosing GHG emissions in the CDP scheme. Jung et al. (2016) argue that lending institutions incorporating carbon risks in lending decisions can often motivate companies to build an overall outstanding corporate governance system and voluntarily disclose GHG information through annual reports, corporate websites or the CDP as a means of presenting their carbon risk awareness to debt markets to minimise agency costs. However, Prado-Lorenzo et al. (2009) do not support agency theory, where firms are unlikely to disclose more GHG information to mitigate agency costs and potential conflicts of interest between shareholders and creditors. Similarly, Amran et al. (2014) find some contrary aspects to agency theory and conclude that large firms in the Asia-Pacific region do not tend to disclose more GHG information to reduce agency costs. Trotman and Trotman (2015) point out that this inconsistency with agency theory can occur where there is insufficient environmental management for monitoring internal audit assurance of GHG reporting to reduce agency costs. The political costs theory assumes that companies are incentivised to provide GHG information to minimise potential litigation costs resulting from political attacks, environmental regulation, industry threats or nationalisation (Jensen & Meckling, 1976). Supporting this theory, Ortas et al. (2015) find that companies with sound financial performance are more inclined to disclose

information on environmental events and circumstances to various stakeholders to justify their enormous profits and reduce political costs.

Based on proprietary costs theory (Verrecchia, 1983, 1990), companies appear to limit the scope and extent of voluntary GHG reporting because of reporting costs, such as preparation costs, disclosure costs and costs resulting from competitors who may use disclosure information to harm reporting companies. The more the proprietary costs associated with GHG reporting, the less likely companies will voluntarily disclose GHG information to minimise information asymmetry and capital costs. Consistent with this theory is Prado-Lorenzo and García-Sánchez's (2010) assertion that companies appear to voluntarily disclose less GHG information because the costs and risks associated with litigation increase with disclosure.

Institutional governance system theory (Griffiths, Haigh, & Rassias, 2007) can be used to explain how governance systems, such as corporate governance, market governance or state governance, are shaped by climate change decisions and the patterns of industrial engagement. Consistent with this theory, Rankin, Windsor and Wahyuni (2011) find that Australian companies tend to shape their corporate governance system for climate change decisions, such as reducing GHG emissions, to gain competitive advantage.

Reputation risk management (RRM) theory, formulated by Bebbington, Larrinaga and Moneva (2008), assumes that companies voluntarily disclose GHG information because of their concerns for reputation and image rather than accountability. In alignment with this theory, using a case study of a large Australian company, Hogan and Lodhia (2011) find a gap between GHG reporting and legitimacy theory on the basis that companies care more about reputation and public image than accountability. It can thus be concluded that RRM theory appears to complement legitimacy theory.

From the perspective of resource dependence theory, supporting a company board with industry expertise, knowledge and skills or relevant resources (Boyd, 1990) allows management to engage with cognition of GHG reporting and explore a joint method to achieve company objectives and mitigate the costs associated with climate change risks (Pfeffer & Salancik, 2003). Trotman and Trotman (2015) support this theory and indicate that the decisions regarding GHG reporting depend on management's assessment of climate change risks.

According to Bourdieu's theory of practice (Bourdieu, 1977), the decision on environmental reporting is based on actors' habits and past experiences rather than rules. Lodhia and Jacobs (2013) analyse the pattern of environmental disclosure on the part of Australian Commonwealth departments and suggest that Bourdieu's theory of practice is a powerful tool for explaining why and how environmental disclosure occurs, since it emphasises individual actors and reporting practices. They also argue that internal actors and organisational practices, rather than the notion of external legitimacy, are likely to offer stronger explanations for voluntarily environmental reporting.

The prior analysis of the theories addressed in relevant articles yields mixed results for using such theories to explain the incentives for Australian companies to participate in voluntary GHG reporting (see Appendix 4). However, there are exceptions to this conclusion, as not all the theories were applied in every study. Researchers seem to have adopted a piecemeal approach by applying one, two, three or four theories to investigate companies' motivations regarding voluntary GHG reporting. The results cannot be fully explained by one theory alone (Trotman & Trotman, 2015). In addition, both voluntary disclosure theory (signalling theory) and agency theory are limited in their ability to explain the scope of environmental reporting as, quite often, the intended target of those reports are analysts who deal with transactions in the market with efficient information exchange (Ortas et al., 2015). As it is unlikely that most potential report users engage in such markets, several researchers apply legitimacy theory. This may explain why they need to go beyond a standard theoretical precept and adopt a combination of various theoretical perspectives to explain environmental disclosure (Lodhia & Jacobs, 2013). It could be argued that understanding the motivations behind voluntary environmental reporting depends on a framework of multiple theories that offer cognition of the complexity of organisational responses and incentives at various levels of influence (Ortas et al., 2015).

4.2.2 The factors that affect companies' cognition of voluntary GHG reporting

Different companies have different understandings of voluntary GHG reporting. Based on a company's understanding, they respond with their particular GHG disclosure. Accordingly, this study investigates possible factors that influence a companies' cognition of voluntary GHG reporting and how that may affect the cognition in practice.

Haigh (2008) conducts a case study to investigate how four Australian organisations within the electricity supply industry engage in environmental markets under the influence of government, regulation and politics. Haigh's study indicates that organisational responses to environmental change, the government regulatory environment and environmental market strategy play a vital role in the cognition of voluntary GHG reporting. Voluntary GHG disclosure by four Australian organisations is a response to carbon-constraining regulation, whereas among European and United States (US) organisations, a strong interplay exists among environmental actions, political activities and environmental regulations that affect their actions and cognitions.

In a qualitative content analysis conducted by Newell et al. (2009), the authors note that it is impossible to consider climate change in isolation from sustainability development issues, because existing policies, state capacity and legislation are key factors that influence decisions on GHG disclosure in practice. The cognition of GHG issues in practice is different as a result of various institutional regulations and procedures. In effect, such practice is the process of understanding a set of policies, government interventions and strategies that can steer firm's financial flows to a level that requires them to reduce and disclose GHG emissions.

A quantitative content analysis of annual reports undertaken by Cowan and Deegan (2011) highlights a growing number of Australian companies starting to voluntarily disclose GHG emissions because of government regulations, such as the NPI and the NGER Act 2007. Regulations, together with community pressure, provide opportunities for companies to recognise inefficiency. In accordance with governmental perspectives, Australian companies narrow the legitimacy gap and enhance their environmental performance by deciding to disclose GHG information to the public.

Constructing regression models based on large companies from 33 countries, including 106 Australian companies, Luo and Tang (2015) find that the cultural dimensions of Power Distance (PD), Masculinity (MAS) and Uncertain Avoidance (UA), tend to influence GHG disclosure. Managers with high power levels are less likely to care about environmental issues because GHG disclosure significantly influences powerless rather than powerful groups. MAS makes managers ignore GHG issues, as their primary focus tends to be economic achievements. Managers with strong UA preference are more inclined to recognise, prepare and report GHG issues for managing any potential risks and effects resulting from GHG emissions.

Using regression models, Lee, Jung and Hwang (2016) find that 46% of Australian companies participate in voluntary environmental programs (VEPs) to mitigate GHG emissions and enhance transparency of GHG reporting. Government supervision and economic instruments can influence a company's decisions on whether to participate in VEPs. With the timely support of governments, companies are more likely to be aware of and improve GHG disclosure by participating in VEPs to enhance their reputations. Financial subsidies, as an economic instrument, induce companies to set aside cost bias, as it motivates them to take part in VEPs for determining cooperative actions in response to government assistance.

Interestingly, by using regression models, Gabe (2016) argues that the relationship between voluntary energy-performance disclosure of GHG emissions for Australian commercial buildings and mandatory disclosure regulation is tenuous. For urban policymakers, the performance of mandatory adopters is likely to be estimated by extrapolating the performance of voluntary adopters. Consequently, enforcing mandatory reporting regulation appears not to affect a company's decisions and cognition in relation to voluntary GHG disclosure.

In summary, there is a consensus among most researchers that government supervision, politics, environmental regulations and policies, state capacity, culture and economic instruments will most probably influence a company's cognition of voluntary GHG reporting. The outlier in terms of the role that the mandatory disclosure policy plays in voluntary reporting is the work of Gabe (2016). Although two studies adopt a qualitative approach, their results seem difficult to apply across industries within Australia. One is a qualitative study (Haigh, 2008) that merely focuses on the electricity supply industry, and the other (Newell et al., 2009) is limited to a macro-level (e.g., regulations, policies) rather than micro-level analysis. Further, most previous studies (e.g., Gabe, 2016; Luo & Tang, 2015) do not establish how the factors influence a company's cognitions and decisions in practice. In effect, these studies focus on establishing a causal relationship by adopting a quantitative approach that may generate inefficient results and artificial situations resulting from human errors, lack of personal views, and involving subjective responses hidden behind statistical procedures (Ismail & Zainuddin, 2013).

4.3 Process: Management system for GHG reporting

Environmental management systems (EMSs) can be described as functional tools for formulating GHG strategies to respond to social expectations (Klassen & McLaughlin, 1996). External expectations drive companies to commence GHG strategic activities to establish and

implement EMSs (e.g., CMSs) to mitigate GHG emissions and prepare GHG reports (Tang & Luo, 2014). The reviewed articles are discussed in this section to reveal what factors affect the implementation of CMSs and whether CMSs or GHG strategies improve the transparency of voluntary GHG disclosure.

Hrasky (2011) conducts a quantitative content analysis, comparing GHG disclosure within the sustainability and annual reports of ASX's top 50 Australian companies in 2005 and 2008. This study finds that both symbolic impression management and behaviour management can maintain a social contract. By adopting symbolic impression management, companies pay more attention to establishing a sense of environmental response and responsibility without taking any action to change business operations, whereas applying behaviour management tends to encourage active steps to reduce GHG emissions, which can significantly satisfy stakeholder expectations. Small polluters, such as companies in the financial sector, tend to adopt symbolic impression management to engage in self-interested behaviour and portray a positive image. Therefore, a regulatory response should be applied in establishing a reporting regime that relates to the actual activities of environmental and social responsibility, because the symbolic strategy for voluntary GHG reporting is insufficient for informing stakeholders.

In a global survey of eight GHG emission-intensive industries, including Australian steel-production companies, Sprengel and Busch (2011) find that companies formulate strategies to disclose and mitigate GHG emissions because they tend to respond to stakeholders' overall collective expectations, such as stakeholders' focus on regulation and total environmental quality. Contextual factors, such as the level of a company's pollution, appear to influence the choice of strategies for responding to GHG emissions, whereas industry and regional affiliations do not. Accordingly, developing climate policies that merely target companies within a defined broadly sector may be ineffective.

Using an analysis of a large Australian company's annual reports and sustainability reports, Hogan and Lodhia (2011) indicate that this company tends to implement RRM strategy to establish a reputation for being honest in GHG reporting to respond to environmental regulations. The regulations affect the quality of GHG disclosure because companies place a premium on maintaining GHG disclosure reliability by implementing a proper RRM strategy to manage the reputation risks imposed by regulations. The regulations are also more likely to provide clear directions on RRM strategy, which reinforce and ensure that GHG disclosure meets societal needs.

Focusing on CMSs, Tang and Luo (2014) adopt a regression model based on 2010 CDP reports of 45 top Australian companies. They find that companies with superior CMSs can achieve better GHG mitigation by strengthening board function, establishing effective risk and opportunity assessment, creating emissions targets, implementing carbon policy and enhancing disclosure and communication with external stakeholders. GHG disclosure is a primary driver for building powerful CMSs, as high-level GHG emissions transparency assists investors in monitoring and improving a company's GHG performance by revealing that company's GHG strategy.

In a study of 21 large energy businesses located in (14) and outside (seven) Australia, using a qualitative content analysis of sustainability reports and framed by GRI G3 indicators, Talbot and Boiral (2015) find that GHG disclosure suffers from a lack of transparency and consistency. Companies tend to avoid complying with GRI guidelines by using impression management strategies to manage GHG reporting, and play down the significance of unmeasured GHG emissions, affirming this as a general practice within the industry; companies also apologise for undisclosed GHG information. Participants promise future improvement, deliberately failing to disclose certain GHG emissions and manipulating GHG data. Such strategies tend to alter stakeholder perceptions by minimising or concealing evidence of actual GHG performance.

Doda, Gennaoli, Gouldson, Grover and Sullivan (2016) apply a regression model to investigate the short-run relationship between GHG emissions and Carbon Management Practices (CMPs) across large companies from Australia, European and Japan using CDP reports. They indicate that limited evidence supports GHG emissions mitigation being influenced by CMPs because of self-selecting information to report that may not reflect the real effect of a company's CMPs. A possible explanation for the lack of a correlation is the focus on relative rather than actual GHG performance.

Regression models conducted by Yunus et al. (2016) analyse the determinants of Carbon Management Strategy (CMS) adoption using the published reports and corporate websites of the top 200 listed Australian companies. This study identifies that the presence of EMSs, establishing an environmental committee, board size and board independence can influence businesses' adoption of CMS to manage and report GHG information. Firm size, the environmental sensitivity of a company's industry and its leverage also affect CMS adoption, while larger companies from environmentally sensitive industries and highly leveraged

companies have greater incentives to use CMS for reporting GHG emissions to ward off any potential threats to their legitimacy.

As an extension of Tang and Luo's work (2014), Luo and Tang (2016) adopt a regression model to investigate the determinants of CMSs quality by analysing the CDP reports of large international companies, including Australian companies. They find that ETS, the legal system, competitor pressure, GHG exposure and firm size can positively influence CMSs quality. By contrast, the level of a country's development, Return on Assets (ROA) and carbon intensive level can negatively affect CMSs quality. Pressure from competitors tends to motivate companies to minimise the risks of GHG emissions by building high-quality CMSs to gain competitive advantage, displace competitors, enhance reputation or expand market share. Companies with high GHG exposure tend to establish effective CMSs for pre-empting mandatory GHG regulations and managing GHG risks.

In summary, most researchers (e.g., Tang & Luo, 2014; Yunus et al., 2016) reach a consensus on the factors that can influence the adoption and quality of CMSs or GHG strategies to process GHG information. These include internal factors (e.g., board function, firm size) and external factors (e.g., legal system, competitor pressure). Equally, some researchers (e.g., Hrasky, 2011; Talbot & Boiral, 2015) agree that carbon management does not enhance transparency, as companies appear to employ impression management to conceal some GHG issues, such as GHG performance. However, since these results are from large companies, they may not be generalisable to all Australian companies because of size differences. Studies that rely on various reports (e.g., GRI reports, CDP reports) may also not reflect a company's real GHG performance in practice. Although studies establish the determinants of CMSs through empirical analysis, they do not reveal how the factors influence CMSs in practice, which indicates the necessity of obtaining practitioner views based on their experiences.

4.4 Output: Determinants of voluntary GHG reporting

More than half of the studies in the articles identified for this research focus on the output of voluntary GHG reporting. In this section, the selected articles are reviewed based on the four categories of the nature of voluntary GHG reporting decisions: the possible factors that affect the extent, quality and adoption of voluntary GHG reporting, the influence of assurance on voluntary GHG reports, the forms used for voluntary GHG reporting and the reporting practice relating to quantity and quality of GHG information.

4.4.1 Reporting decisions concerning extent, quality and adoption

As discussed in section 4.2.1, earlier studies investigating reporting decisions relating to the extent, quality and adoption of voluntary GHG reporting use a wide range of theoretical frameworks. That discussion not only highlights the inconsistencies in theory application in those studies, but finds that researchers mainly use empirical studies to examine a company's reporting decisions.

Drawing on those theories, 16 articles formulate hypotheses to examine the relationship between the determinants and voluntary GHG reporting. This section explores seven main determinants that can influence a company's decisions on the extent, quality and adoption of voluntary GHG reporting: economic determinants, sustainability performance, board function, industry sensitivity and institutional macro-context, forms, Hofstede's culture dimension (1980) and non-financial stakeholders (see Appendix 5). Some other determinants found in the analysis of a few studies are unrepresentative and not included in Appendix 5—these are location, foreign sales, indebtedness ratio, signatories, environmental litigation risks and certified EMSs. Although the Appendix section shows that authors explore various themes within the emerging research fields, they have not identified an overarching theme for those determinants.

Economic determinants include Firm Size, Market to Book (MTOB) ratio and Financial Performance and Position, while Financial Performance and Position contains Return on Equity (ROE), ROA, Leverage, Stock Price Volatility, Tobin's Q Ratio and Capital Intensity. Compared with MTOB, Firm Size and Financial Performance and Position are the most frequently investigated variables and sometimes used as control variables in regression models. Firm Size measured as total revenue, total assets or market capitalisation can be seen to have a positive effect on the extent, quality and adoption of voluntary GHG reporting. Working under the assumption that larger firms deal with more activities that influence the environment, those firms attract more public attention, and therefore face increased pressure and scrutiny from various stakeholders (e.g., Luo et al., 2012; Rankin et al., 2011). Most of the studies selected for analysis in this section support this assumption. The only exceptions are three studies (Amran et al., 2014; Comyns, 2016; Oates & Moradi-Motlagh, 2016) that find Firm Size has no significant effect on firms' decisions regarding the extent and quality of voluntary GHG reporting. Using the sample of large firms may lead to this overall consistent empirical result of Firm Size. MTOB, represented as company's growth opportunities, assumes that

disclosing more GHG information can assist firms in predicting future revenue and growth opportunities (e.g., Gallego-Álvarez, 2012; Prado-Lorenzo & García-Sánchez, 2010). The empirical results of MTOB are mixed and inconsistent.

ROE and ROA often measure financial performance and profitability. According to these measures, profitable firms appear to have more resources allocated to voluntarily disclose GHG information to reveal good news and manage image as an environmental response (e.g., Clarkson et al., 2011; Prado-Lorenzo et al., 2009). Use of ROA is much higher than ROE. This may be because ROE reflects shareholder views to a larger extent, whereas ROA is more closely related to efficiency and financial performance (Prado-Lorenzo et al., 2009). The overall empirical results of ROE and ROA show that profitability is not a strong predictor of voluntary GHG reporting. Interestingly, one study's view (Prado-Lorenzo et al., 2009) is opposite to the assumption of profitability measured by ROE. Moreover, some studies (e.g., Alrazi et al., 2016; Guenther et al., 2016) assume that highly leveraged firms provide voluntary GHG reporting to reduce pressures from creditors and mitigate agency costs related to their social responsibility activities. The overall empirical results for Leverage are similar to those of profitability, whereas Cotter and Najah (2012) indicate that only non-CDP leveraged firms support the assumption. Ortas et al. (2015) also support this assumption. In terms of Capital Intensity, companies with a high amount of capital tend to disclose more GHG information to inform their innovative technologies and the newness of assets that mitigate GHG emissions (e.g., Alrazi et al., 2016; Guenther et al., 2016). Half of eight studies support this assumption; however, the remaining four (e.g., Alrazi et al., 2016; Guenther et al., 2016), indicate a non-significant effect of Capital Intensity.

Two additional variables, Stock Price Volatility and Tobin's Q Ratio, are also used as proxies for Financial Performance and Position. However, they are not commonly used, and the empirical results they generate are ambiguous and unclear. Stock Price Volatility measured by the investment of stock return may be positively related to the level of information asymmetry and, therefore, firms with high-level volatility tend to voluntarily disclose GHG information to reduce information asymmetry and capital costs (Alrazi et al., 2016; Guenther et al., 2016). All four studies do not support the assumption, and Guenther et al. (2016) posit a contrary view. Tobin's Q Ratio is measured by the total market value of share deals with the level of intangible assets and has two opposite assumptions. Firms with a low Tobin's Q ratio have more environmental effect, and such companies are thus likely to disclose GHG information (Alrazi

et al., 2016). Firms with a high Tobin's Q ratio tend to provide GHG reporting to reduce information asymmetry (e.g., Clarkson et al., 2011; Luo & Tang, 2015). Overall empirical results of the Tobin's Q Ratio are similar to the profitability, but only Luo and Tang (2015) support the second assumption.

Sustainability performance includes GHG Performance and Asset Newness. GHG Performance refers to environmental or carbon performance. It is anticipated that firms with good GHG performance are likely to disclose more GHG information voluntarily than firms with poor performance (Clarkson et al., 2011). Seven empirical results for GHG Performance are inconsistent. Clarkson et al. (2011) note that poor performers provide more GHG disclosure than good performers, whereas four studies (Gallego-Álvarez, 2012; Guenther et al., 2016; Luo & Tang, 2014; Oates & Moradi-Motlagh, 2016) find a positive effect of GHG performance on the extent or adoption of voluntary GHG reporting. Sutantoputra et al. (2012) find that GHG performance does not affect the extent of voluntary GHG reporting, while Alrazi et al. (2016) do not find a significant relationship between GHG performance and the quality of voluntary GHG disclosure. Asset Newness refers to the age of assets, and it is expected that firms with more older assets disclose more GHG information, because older assets produce more environmental effects than new assets (e.g., Alrazi et al., 2016; Sutantoputra et al., 2012). Half of the six studies (Clarkson et al., 2011; Luo et al., 2012; Sutantoputra et al., 2012) indicate that Asset Newness does not affect voluntary GHG reporting. The remaining three studies (Alrazi et al., 2016; Gallego-Álvarez, 2012; Luo & Tang, 2015) produce the expected effect.

Board function comprises Corporate Environment Committee (CEC), Corporate Governance Quality (CGQ), Independence, Duality, Board Size and Diversity. A few studies investigate elements of board function as GHG reporting determinants. Firms with a CEC tend to voluntarily disclose GHG information (Luo & Tang, 2015; Rankin et al., 2011). According to Amran et al. (2014) and Prado-Lorenzo and García-Sánchez (2010), independent directors have greater incentive to protect stakeholders' interests and maintain firms' social responsibility. Larger board size reduces the amount of GHG information disclosed, because the larger the board, the less efficient its communication and coordination. Firms with female members tend to have more social responsibilities to participate in GHG reporting. The empirical results of four variables (CEC, Independence, Board Size and Diversity) are mixed and inconsistent. By contrast, the empirical results of CGQ are consistent, and support the assumption that firms with strong corporate governance are more likely to address climate

change issues and disclose GHG emissions (Amran et al., 2014; Rankin et al., 2011). Although empirical results support assumptions of Chief Executive Officer (CEO) duality, Amran et al. (2014) assume that companies practising CEO duality disclose less climate change information, which is contrary to the assumption of Prado-Lorenzo and García-Sánchez (2010).

Industry sensitivity and institutional macro-context include Intensive Industry, Legal Enforcement, EU-ETS and the Kyoto Protocol. These are relatively popular determinant categories that researchers are interested in investigating. According to Intensive Industry, firms from an industry sector that is sensitive to GHG emissions tend to disclose GHG information in accordance with environmental regulation requirements (e.g., Prado-Lorenzo & García-Sánchez, 2010; Rankin et al., 2011). In terms of Legal Enforcement, firms in highly regulated countries are more likely to disclose credible GHG information than firms in low regulated countries (e.g., Luo et al., 2012; Prado-Lorenzo & García-Sánchez, 2010). The empirical results of Intensive Industry and Legal Enforcement are inconsistent and mixed. According to EU-ETS, firms with trading in this scheme tend to disclose higher quality GHG information voluntarily than firms without trading in the scheme (e.g., Comyns, 2016; Rankin et al., 2011), which is supported by three studies (Alrazi et al., 2016; Comyns, 2016; Luo et al., 2012). However, two studies (Luo & Tang, 2015; Rankin et al., 2011) are inconsistent, identifying no relationship. The empirical results of the Kyoto Protocol are incompatible because Luo et al. (2012) do not support the assumption that firms from countries that have ratified the Kyoto Protocol are more likely to disclose greater GHG information than those in countries that did not ratify the Kyoto Protocol (e.g., Luo et al., 2012; Prado-Lorenzo et al., 2009).

Very few studies investigate the last three categories of voluntary GHG reporting determinates using regression models. Specifically, firms using the GRI or CDP tend to disclose high-quality GHG information (Comyns, 2016; Cotter & Najah, 2012; Rankin et al., 2011); empirical results are consistent and support this statement. Luo and Tang (2015) investigate the influence of Hofstede's culture dimension (1980), including MAS, PD, UA, Individualism (IND) and Long-term Orientation (LTO). They assume that managers with MAS and strong PD are unlikely to be accountable for the potential risks caused by their companies' GHG emissions. By contrast, managers with high UA, IND and LTO are more likely to participate in voluntary GHG reporting. All findings of this study (Luo & Tang, 2015) support the influence of Hofstede's culture dimension (1980) and establish a culture-GHG linkage. Non-financial

stakeholders include GHG Politics, General Public, Media, Employee and Customer. According to Guenther et al. (2016), GHG Politics highlights that firms from countries with superior GHG Politics are more likely to be motivated to comply with their GHG reporting obligations. The General Public argues that communities in those countries believe they can leverage institutions, such as the courts, to compel companies to disclose more GHG information. The Customer holds the opinion that companies disclose more GHG information to attract potential new customers and retain current customers. The empirical results of these variables (GHG Politics, General Public and Customer) support the proposed relationships. The Media assumes that the more concern the media shows for climate change, the more GHG information companies will disclose (e.g., Alrazi et al., 2016; Guenther et al., 2016). The Employee affects GHG disclosure because companies disclose more GHG information to attract potential employees and enhance the relationship between labour unions and existing employees (Guenther et al., 2016). The empirical results of Media and Employee are mixed and inconsistent.

As summarised in Appendix 5, although researchers analyse the effects of various determinants on the extent, quality and adoption of voluntary GHG reporting, only a few variables (Firm Size, ROA and Leverage) receive significant attention and demonstrate broadly consistent results to reach clear conclusions. Most determinants (e.g., GHG Performance, Legal Enforcement) have inconsistent results. Further, it is noted that research on the determinants with respect to culture and non-stakeholders are rare and thus require further investigation. Most researchers neglect the quality and adoption of voluntary GHG reporting, as they are likely to be challenging to evaluate. These inconsistent results regarding the extent, quality and adoption level of voluntary GHG reporting suggest that a shift from analysis published reports towards a more exploratory and confirmatory analysis approach would provide valuable insights.

4.4.2 Assurance of voluntary GHG reporting

Assurance of GHG statements assists in enhancing the quality of GHG information (Institute of Chartered Accountants Australia, 2013). From an international perspective, GHG assurance practices are based on the International Standard on Assurance Engagements (ISAE) 3000 and ISAE 3410 (International Federation of Accountants, 2017). GHG assurance practice indicates an increasing demand for a separate assurance standard for GHG disclosure (International Auditing and Assurance Standards Board, 2013). Australia has issued specific standards for

assurance of GHG reporting within the NGER Act 2007 that are voluntary. Thus, this section attempts to address the influence of assurance on the credibility of GHG information disclosed by companies.

Using an experimental questionnaire completed by business students from two Australian universities, Hodge, Subramaniam and Stewart (2009) find that the level and type of assurance practitioner influence a user's confidence in GHG disclosure, as GHG reports with assurance statements tend to achieve greater relevance and reliability. Their study indicates that regardless of whether voluntary or mandatory GHG reporting applies, to improve current sustainability assurance practice, it is necessary to develop appropriate assurance guidelines and standards to enhance the credibility and consistency of GHG disclosure.

Simnett et al. (2009) reach a similar conclusion to Hodge et al. (2009), whereby a particular international assurance standard covering various monitoring methodologies for GHG reporting is required. Mandatory GHG reporting, GHG reporting relating to ETS and voluntary GHG reporting can be assured to improve credibility and confidence in GHG disclosure. Nevertheless, various reporting forms and measurement technologies used to disclose GHG emissions can result in inconsistency and inefficiency of reporting criteria. Therefore, developing a new accounting standard with appropriate measurement and disclosure criteria is necessary for all types of GHG reporting.

Olsen (2010) identifies five potential challenges for auditing GHG information: a) the roles of practitioners are not established well enough; b) using a voluntary basis, firms are likely to adopt varying levels of accuracy and boundary conditions that lead to potential miscounting or double counting GHG emissions; c) there is a lack of global standards relating to the competencies required by GHG reporting or assurance of GHG reports; d) the calculation of GHG emissions might be false owing to changes in conversion factors; e) a growing number of companies disclose GHG emissions voluntarily, yet only a few have the information audited independently. Olson's study indicates that cross-functional skills and knowledge of the estimation, process and operation of GHG emissions are required by GHG auditing to ensure the credibility of GHG reporting.

In an analysis of the contributions made by independent and interdisciplinary research to climate change accounting, Milne and Grubnic (2011) find a range of challenges and difficulties to accounting GHG emissions owing to the uncertain and complex estimation

methods used. Vested lobby and political interests also tend to be involved in designing, operating, auditing and reporting GHG emissions mitigation schemes, which presents obstacles to the extent and content of GHG reporting. Their study provides many worthy areas within voluntary and compliance sectors that undoubtedly need further improvement, such as assurance of voluntary GHG reporting, measurement and calculation for GHG emissions.

Green and Li (2011) find expectation gaps between shareholders, GHG reporters and assurers in the assurance of GHG emissions in the Australian context. The main differences are attributed to high-level uncertainty in collecting and reporting GHG emissions, the responsibilities of management and assurers and the decision usefulness and credibility of GHG statements. Assurers feel they are less responsible to report users than emitters, whereas emitters and shareholders suspect that assurers focus on report users. In particular, all three groups of stakeholders feel that GHG assurance statements are not useful for decision-making. As a result, new GHG assurance standards and mechanisms are warranted to minimise potential expectation gaps and develop specific definitions and criteria for GHG emissions.

In their review of CDP reports of firms from 43 countries, including Australia, Green and Zhou (2013) find that although there is an increasing trend for businesses to assure their GHG reports from 2007–2009, the respondents hold various perceptions regarding the verification of GHG reporting that can influence the reliability and development of the assurance market for GHG reporting. In effect, two types of assurance providers, including specialist and auditing firms, provide various levels of assurance, owing to the absence of an international standard from the accounting profession. Consequently, it is necessary to establish an acknowledged regulatory framework to ensure the quality of GHG disclosure and the comparability of GHG information across different jurisdictions.

As an extension of previous studies on external assurance of GHG reporting, Trotman and Trotman (2015) interviewed 29 Australian listed companies to gain insight into the role of internal auditors in voluntary GHG reporting. They argue that internal assurance of GHG reporting appears to be the mainstream method for companies, because internal auditors are accountable to various parties within a corporate governance framework, such as management, audit committees and environmental managers. The major factors that significantly determine internal audit involvement include compliance with regulation, risk management, potential penalties, industry type and reporting reputation, but these major factors need further experimental examination.

To identify external assurance decisions for enhancing the quality of GHG reporting, Zhou, Simnett and Green (2016) examine the country-level factors' (e.g., business culture, legal systems) and company-level factor's (corporate governance) influence on companies' decisions to purchase external GHG assurance. Companies from countries with weak legal systems and stakeholder orientation are likely to demand GHG assurance and prefer assurance providers from the accounting profession to satisfy stakeholder expectations. The strength of corporate governance tends to negatively affect decisions about whether to seek external GHG assurance, as companies with strong corporate governance can ensure the credibility of GHG disclosure.

One study that critically analyses the GHG assurance statements of Australian companies uses a content analysis approach. The results of that study, by Bepari and Mollik (2016), indicate that GHG assurance is voluntary in Australia, and its statements are issued to directors or management rather than external stakeholders. GHG assurance practices within Australia are not considered an accountability enabler because of a lack of stakeholder engagement within the assurance process, the limitation of performance indicator selection and assurers' reluctance to address assurance statements for various stakeholders. Therefore, GHG assurance is more likely to be used as an internal control tool to collect data and maintain data accuracy than as an instrument to enhance social accountability.

Appendix 6 shows that all but one of the studies focuses on external GHG assurance. From an international perspective, the studies (e.g., Green & Li, 2011; Green & Zhou, 2013) conducted before the commencement of ISAE 3000 (Revised) and ISAE 3410¹⁵ concentrate on developing international assurance standards and the guidelines of GHG statements. Post commencement, a significant decline can be identified in studies that investigate potential factors influencing GHG assurance practice (e.g., Bepari & Mollik, 2016; Trotman & Trotman, 2015). Among those studies, even fewer are likely to generate convincing conclusions. This may be because of the lack of data on GHG assurance. Further, the overall findings show that Australian GHG assurance practices are unlikely to be functioning well enough to ensure the quality and reliability of GHG disclosure—therefore, an international regulatory framework is warranted.

¹⁵ In September 2013, the International Auditing and Assurance Standards Board approved ISAE 3000 (Revised) and ISAE 3410 (Assurance Engagements on Greenhouse Gas Statements) at its meeting.

4.4.3 Forms used for voluntary GHG reporting

In addition to adopting regression models to examine the influence of the CDP and GRI on the extent and quality of voluntary GHG reporting, some researchers also investigate whether the GRI, CDP and CDSB are effective forms for guiding high-quality GHG disclosure. The selected studies are reviewed individually, and some of their relevant findings and conclusions summarised, in the following analysis.

Kolk, Levy and Pinkse (2008) indicate that carbon disclosure via the CDP reflects a procedure of international convergence and successful institutionalisation. They find that an increasing number of companies respond to the CDP to anticipate mandatory control or gain competitive advantage. However, the GHG disclosure via the CDP lacks consistency, details, reliable inspection and valuable GHG information, meaning that it is unlikely to help investors make decisions. Although CDP signatories that do not impose requirements assist in attracting more potential investors, this may render the relationship between companies and report users loose and ineffective.

In examining the GHG reporting practices of a subsector of the AFBI, Cuganesan et al. (2010) find that although GRI G3 indicators frame GHG disclosure, companies with intensive social and environmental influence may engage in structural choice, including altering public expectations and deflecting attention rather than changing their real GHG performance. The findings indicate that companies play down GHG information by engaging in negative activities that cannot meet public perceptions. As a result, policymakers should develop GHG guidelines for the subsector of AFBI rather than merely adding GHG guidelines to a one-size-fits-all reporting framework, because environmental disclosure is a major part of business operations instead of external activities.

Mudd (2010) investigates the historical trends of GHG issues for the Australian mining industry. According to a range of voluntary and core GRI indicators, Australian mining companies disclose environmental issues to enhance transparency, comparability and uniformity of GHG disclosure relating to their sustainability performance. Mining companies do not report complete data on GHG emissions and reference conversion factors of carbon costs, although such issues are required as core indicators of GRI. The GRI, as a voluntary protocol, continually improves the clarity and transparency of GHG disclosure, but GHG disclosure using GRI indicators still requires improvement in consistency through enhancing

external assurance standards and internal assurance processes to disclose GHG information explicitly.

In a case study of a larger Australian company, Cotter et al. (2011) argue that GHG disclosure made by CDP reports is greater than that made by sustainability reports framed by GRI G3 indicators. GHG disclosure using GRI indicators is based on a company's choice and is insufficient to meet institutional investor needs, because it tends to highlight positive aspects and fall short of disclosing certain areas of climate change effect, environmental management and technical details. The scope of GRI indicators is too broad to report GHG emissions, and the GRI is unlikely to facilitate the inclusion of all GHG information required by institutional investors. CDP reports can complement GRI reports in communicating to larger investors. However, CDP reports are not an appropriate alternative to providing sufficient GHG disclosure for two reasons: a) registration constrains the accessibility of CDP data; b) it is difficult and inconsistent for users to interpret CDP data because of insufficient commensuration of GHG disclosure. By contrast, CDSB is more likely to minimise the gap because it aligns with the qualitative characteristics of the International Accounting Standards Board (IASB) Conceptual Framework, which focuses on information useful to decision-making.

Sciulli's (2011) case study of a Australian local government council indicates that the local government council works in isolation to deal with GHG disclosure. GRI indicators do not influence local government councils' GHG reporting practices in relation to accounting GHG emissions. The comparability of GHG disclosure among local government councils is weak because GRI indicators are voluntary and lack mandatory guidelines for the specific content of GHG reporting. Therefore, a regulatory framework should be established by local governments to coordinate and structure their climate change responses to enhance comparability.

Matisoff, Noonan and O'Brien (2013) indicate that companies can gain recognition beyond compliance and distinguish themselves from competitors by disclosing GHG information via CDP reports. The CDP plays a unique role in promoting disclosure of Scope 2 and Scope 3 GHG emissions, whereas mandatory GHG reporting is unlikely to address Scope 3 GHG emissions. The CDP has started to grade companies based on the quality of their responses to collect more useful information and enhance internal management of GHG emissions. This not only stimulates GHG disclosure and verification, but also assists in establishing norms for the

methodology of GHG emissions accounting. However, the CDP is a voluntary reporting scheme, and thus lacks uniformity, comparability and standardisation across companies.

By analysing the GRI reports of economic sectors, including Australian industries from 1999 to 2011, Alonso-Almeida, Llach and Marimon (2014) find that the energy and financial sectors widely adopt GRI indicators. Energy sectors are motivated to use the GRI to maintain sustainability and reputation, whereas financial sectors are more inclined to adopt the GRI for attracting potential investors, improving their image and regaining market credibility through legitimising behaviours. The GRI tends to be an effective form of disclosing GHG emissions because it increases visibility for capital markets and develops from G3 to G4 generation to enhance relevance and comparability. Nonetheless, in accordance with Cuganesan et al. (2010), they conclude that the GRI must develop specific sector guidelines to improve flexibility for addressing various sectors' perspectives on GHG issues.

Siew (2015) offers an overview of the methodology and criteria proposed by the GRI and the CDP. GHG disclosure levels (A, B and C) using the GRI depend on a company's choice, while the CDP scores primarily focus on the completeness and quality of companies' disclosure rather than judging their GHG performance. Although the GRI and CDP are relevant and useful forms to guide companies to achieve sustainable goals, there are inconsistencies in the reporting requirements owing to varying methodology and criteria that leads to a complicated understanding for different stakeholders. Consequently, it is necessary to enhance the measurability of criteria, explore inter-link criteria, minimise gaps between companies and GHG report preparation and develop common benchmarks for comparison.

By exploring current accounting practices for dealing with climate change risks, Linnenluecke et al. (2015) find that the accounting function is significantly influenced by climate change, as is evidenced by legislation for GHG reporting. A disclosure function can support organisations' climate change adaptation. The CDP currently deals with disclosure and performance scores to access the level of GHG activities. The GRI and CDP are cooperating to ensure consistent guidelines and indicators for voluntary GHG reporting, while the CDSB is aligned with the IASB and designed to disclose the risks and opportunities of GHG issues for shareholder value within annual reports.

In an analysis of annual reports and sustainability reports of Australian metal and mining firms, Lokuwaduge and Heenetigala (2016) find that the level of compliance with GRI G3 indicators

relating to GHG disclosure differs. Although GRI provides guidelines and indicators for GHG reporting, GRI merely provides detailed quality standards for GHG disclosure rather than the performance of strategies for GHG mitigation. Further, companies can select GRI indicators to report GHG issues, which leads to insufficient comparability of GHG disclosure.

Appendix 7 summarises the main findings. Researchers do critically analyse the nature of voluntary GHG reporting, and the CDP and GRI are identified as the preferred format. Some researchers (Kolk et al., 2008; Matisoff et al., 2013) focus on using CDP reports and argue that voluntary GHG reporting via CDP reports lacks reliable inspection, comparability and uniformity across companies. Other researchers (e.g., Alonso-Almeida et al., 2014; Lokuwaduge & Heenetigala, 2016) concentrate on the GRI and point out that voluntary GHG disclosure via GRI indicators lacks specific guidelines for sub-sectors, consistency, flexibility and binding requirements. In particular, the work of Sciulli (2011) reveals that the GRI is insufficient, and its lack of mandatory guidelines for the specific content of GHG disclosure reduces comparability across local government councils. Some researchers (Cotter et al., 2011; Siew, 2015) also critically analyse the CDP and GRI simultaneously. Although they share the same views as researchers who focus on a single format, Cotter et al. (2011) argue that the CDP can complement the GRI by communicating with larger investors and providing a higher level of GHG disclosure. Interestingly, Linnenluecke et al. (2015) emphasise the positive aspects of the CDP, GRI and CDSB. The GRI evolved from G3 to G4 generation in 2013 (Lokuwaduge & Heenetigala, 2016), but there is no specific investigation of G4 generation used by companies to date. The overall findings indicate that voluntary GHG disclosure via CDP and GRI reports tends to be quite weak because of self-selection. Therefore, developing a regulatory framework with detailed mandatory guidelines is necessary to improve voluntary GHG disclosure by achieving a trade-off between mandatory and voluntary GHG disclosure.

4.4.4 Reporting practice relating to the quantity and quality of GHG information

In addition to previous determinants that can affect the quantity and quality of voluntary GHG reporting, researchers attempt to investigate the state of reporting practices (e.g., measurement and disclosure) regarding the quantity and quality of GHG information disclosed by Australian organisations. In the rest of this section, the selected studies are reviewed and found relevant to the present study. By summarising their most relevant findings and conclusions, this section reveals the current state of Australia's voluntary GHG reporting practices.

In a content analysis of the published reports of five major Australian companies, Haque and Deegan (2010) find that although there is an increasing trend for GHG disclosure, Australian companies' voluntary GHG reporting practices remain low. The quality and extent of voluntary GHG reporting requires improving because companies tend to conceal some GHG information, which leads to the questionable quality of voluntary GHG reporting. The inferior quality of GHG disclosure can reduce comparability and cause investors and other stakeholders to make judgement errors. Therefore, Australian companies should extend GHG disclosure to meet stakeholder expectations and discharge climate change accountability rather than using an absence of GHG accounting standards as an excuse.

Using the content analysis approach, Dong and Burritt (2010) find that Australian oil and gas companies' voluntary GHG disclosure is relatively weak, because these companies tend to provide positive and declarative disclosure rather than complying with voluntary industry benchmarks to provide detailed information about their actual GHG performance and outcomes. The credibility and comparability of social and environmental disclosure decline as a result of disclosure primarily focusing on employee information and ignoring that of other stakeholders. They argue that oil and gas companies should strictly comply with voluntary industry guidelines to enhance the credibility and comparability of GHG disclosure across companies.

By interviewing actors in financial sectors from the US, Europe and Australia, Haigh and Shapiro (2011) find that most financial sectors do not invest heavily in GHG reporting owing to a lack of standardised GHG reporting for quantifying GHG emissions. The findings indicate that voluntary GHG reporting lacks comparability because companies use various measures and calculation methods to report GHG emissions. As a result, voluntary GHG reporting is likely to provide imaginary, symbolic and nebulous information to institutional financial investors.

In a review of financial analyst research, Nelson, Wood, Hunt and Thurbon (2011) find that the financial analysis of GHG risks is ineffective because companies disclose insufficient and less useful GHG information to investors, particularly for Scope 1 and Scope 2 GHG emissions. They point out that it is impossible to develop a single metric to address the effect of GHG emissions pricing across all companies and industries. Consistent calculation methods and scope for GHG emissions are also needed to enhance comparability across companies.

Conducting interviews in Australian companies, Downie and Stubbs (2012) find that inaccurate assessment of Scope 3 GHG emissions results from a lack of mandatory conversion information to translate financial expenses into CO₂-e. Companies tend to use various information sources to obtain conversion factors of GHG emissions that negatively affect the outcome of GHG assessments. Conversion errors lead to low-quality voluntary GHG reporting, because the scope of GHG reporting must extend to cover Scope 3 GHG emissions. To conclude, voluntary GHG disclosure is various in quantity and poor in quality across companies that result in misallocated resources, incorrect decisions and improper strategy choices for decreasing the sale or manufacturing of GHG-intensive products.

In a review of articles relating to environmental performance accountability published in the AAAJ, Burritt (2012) finds that practitioners and researchers do not interface with each other in terms of environmental performance accountability, particularly in how to measure GHG emissions—this remains a controversial topic for practitioners and researchers owing to lack of agreement over standard measurement resulting from climate change risks, opportunities, costs and benefits. Thus, researchers, practitioners and policymakers should collaborate to develop a standard method to measure GHG emissions for improving environmental performance accountability.

Adams, Muir and Hoque (2014) survey Australian federal, state and territory governments for measuring practice of GHG performance. They find that public-sector voluntary GHG reporting appears to be low. Public-sector organisations are unlikely to adopt GRI guidelines to measure GHG performance because they are in a non-competitive environment. Their GHG disclosure does not link to any GHG strategy to enhance GHG performance. Therefore, it is necessary for the public sector to create mandatory GHG reporting or a competitive environment to enhance the GHG disclosure quality.

By analysing the sustainability reports of 45 oil and gas firms, Comyns and Figge (2015) find that although firms adopt external guidelines to prepare GHG reporting, they do not produce high-quality GHG reports. Compared with ‘experience’ information (e.g., project achievement) and ‘credence’ information (e.g., methodologies to quantify GHG emissions), ‘search’ information (e.g., be rewarded) appears to have higher quality. The firms can maintain social legitimacy without enhancing GHG disclosure quality because ‘search’ information is sufficient from their perspective. This indicates that the quality of voluntary GHG disclosure is unlikely to be improved; regulations are thus required.

In a survey of both financial and non-financial stakeholders, Haque and Islam (2015) find that governments and institutional investors generate the most coercive pressure on a company to disclose high-quality GHG information. Corporations are unlikely to report GHG information until non-financial stakeholders (e.g., governments, media) put pressure on them. Non-financial stakeholders play a significant role in affecting GHG reporting practices because their forces are closely connected to the media attention that influences company's reporting practices.

Haque, Deegan and Inglis (2016) extend the work of Haque and Deegan (2010) to survey and interview stakeholders from large Australian energy-intensive companies. They find a gap between GHG disclosure content and stakeholder expectations. Australian companies fall outside the best GHG reporting practices because they disclose less GHG information. Their voluntary GHG reporting is related to how to manage stakeholders rather than how to engage with them. Agreeing with the work of Haque and Islam (2015), they suggest that expectations from powerful stakeholders (e.g., governments) make companies disclose more GHG information than others. However, there are no such expectations from them.

All key findings are summarised in Appendix 8. The common theme is a lack of best GHG reporting practice in Australia. Companies can apply various methods to measure their GHG emissions, as GHG disclosure is voluntary, and no specific GHG accounting standard applies (e.g., Burritt, 2012; Haigh & Shapiro, 2011). As a result, the quality of voluntary GHG reporting to investors and other shareholders is questionable. Most researchers reach a consensus that the various methods used to measure GHG emissions reduce the comparability of voluntary GHG reporting. Interestingly, Downie and Stubbs (2012) extend the work of Nelson et al. (2011) to the Scope 3 GHG emissions that fall outside the scope of the NGER Act 2007 and find the same measurement problem. This problem tends to be severe, and receive extensive researcher attention, because it is a controversial issue among practitioners and scholars (Burritt, 2012). Further, Adams et al. (2014) extend the work of Sciulli (2011) to Australian federal, state and territory governments and indicate that governments are unlikely to generate GHG disclosure expectations because they operate in a non-competitive environment. Therefore, without these expectations, companies disclose less GHG information and provide low-quality GHG reporting (e.g., Comyns & Figge, 2015; Haque et al., 2016). This analysis reflects the debate on mandatory GHG reporting practices versus voluntary GHG reporting practices. This situation requires deeper investigation using larger samples to

examine and verify different methods for measuring the three GHG emissions scopes. Accordingly, cooperation among governments and organisations is necessary to develop a consistent and standard method to measure GHG emissions and ensure high-quality voluntary GHG reporting in Australia.

4.5 Outcome: The influence of voluntary GHG reporting

While several studies have examined the output of voluntary GHG reporting, little research has focused on the outcomes of voluntary GHG reporting. In this section, the reviewed articles highlight the usefulness of GHG reports relating to financial performance, GHG performance and stakeholder decisions.

As discussed in section 4.4.1, the studies involve two central outcome perspectives of voluntary GHG reporting: financial performance and GHG performance. These are closely related to stakeholder decisions and further actions required by business and society. These studies primarily rely on empirical analysis to examine the relationship between two performances and voluntary GHG reporting without gaining any insight into how voluntary GHG reporting influences financial performance and GHG performance. Meanwhile, the empirical results are mixed and ambiguous. Apart from those studies, two others primarily address the influence of voluntary GHG reporting on outcome, including stock price and stakeholder decisions.

By investigating the effect of voluntary GHG reporting on shareholder value, Kim and Lyon (2011) find that investors do reward companies with better financial outcomes because they are satisfied that a company's GHG disclosure complies with environmental regulations. This study supports the conclusion that stock prices will be pushed up by investors who tend to act against climate change when the external business environment increasingly focuses on climate change.

In a quantitative content analysis, Jain, Keneley and Thomson (2015) compare the voluntary GHG disclosure of six big banks from Australia, Japan, China and India to identify the influence of GHG reporting on stakeholder decisions. They find that Australian banks have a high level of environmental disclosure, particularly when it comes to providing detailed GHG information that is valuable for stakeholder decisions. This study also confirms the utility of information provided through voluntary GHG disclosures in stakeholder decision-making. Further, in contrast to the works of Haigh and Shapiro (2011) and Hrasky (2011), they argue

that voluntary GHG disclosure in the banking sector increases the depth and breadth of the content to help stakeholders make decisions.

4.6 Discussion of the research gaps and central themes

The different perspectives, relationships, consistencies, inconsistencies and underexposed themes of the reviewed articles have been identified using the Input-Process-Output-Outcome model. This section explores the underrepresented research areas, future research trends and central themes that arise from this thesis.

Two key themes are identified from the systematic literature review: a) researchers predominantly adopt quantitative approaches to establish relationships between determinants (e.g., government supervision, culture) and voluntary GHG reporting rather than investigating how determinants influence voluntary GHG reporting in practice; b) the reviewed literature focuses on large local and multinational companies, and only four research studies (e.g., Adams et al., 2014; Oates & Moradi-Motlagh, 2016) address Australian government sectors. Although non-financial stakeholders (e.g., governments, media) are more likely to affect GHG disclosure directly, only a few reviewed articles (e.g., Alrazi et al., 2016; Guenther et al., 2016) investigate such influence.

In terms of the Input findings, the most significant insight is that a lack of convincing evidence exists to support the position that incentives for voluntary GHG reporting can be explained by theories or frameworks in isolation. This research confirms the arguments of Lodhia and Jacobs (2013) and Trotman and Trotman (2015), in which researchers should go beyond the scope of standard theory and adopt different theoretical perspectives to explain GHG disclosure, as isolated theories cannot illuminate the reasons why companies are motivated to disclose GHG emissions voluntarily. The reviewed articles use theoretical explanations in isolation rather than providing a holistic framework of multiple theories to explain the incentives for voluntary GHG reporting. Further, this literature review finds that some theories are inconsistent with a number of studies. Therefore, there are opportunities for future researchers to develop a robust and holistic framework with multiple theories to provide more stable explanations and more explicit assumptions to ground empirical studies by going beyond the isolated cases.

In relation to Process, a remarkable insight is that there is insufficient evidence to demonstrate environmental management practices and internal incentives addressing GHG emissions. Based on an analysis of various reports, some researchers (e.g., Talbot & Boiral, 2015) argue

that large Australian companies tend to adopt impression management strategies to manage GHG reporting; therefore, GHG disclosure does not reflect real GHG management practices. This result calls for regulatory policies that relate to actual GHG activities. In effect, analysis of various reports is limited to capturing the complex dimensions of environmental management practices (Yunus et al., 2016). Some studies (e.g., Luo & Tang, 2016) investigate possible factors (e.g., legal system, competitor pressure) that can influence the adoption and quality of environmental management strategies. However, those studies exclude the interaction effects of those factors and are grounded in limited theories (stakeholder theory, legitimacy theory, institutional theory and RRM theory) to explain the potential influence. This might create opportunities to develop a comprehensive theoretical explanation to ground empirical studies relating to the adoption and quality of GHG management strategies. Future researchers also should consider using case studies to gain a richer insight into how companies apply environmental management strategies and their effectiveness.

The third aspect of this systematic literature review is Output, and areas requiring further research are identified as follows. For the determinants relating to the extent, quality and adoption of voluntary GHG reporting, most variables produce inconsistent results. Only a few variables have consistent results that enable a clear conclusion. Deeper investigation should be conducted using additional research methods. Although internal audits play an important role in ensuring the reliability of GHG data (Trotman & Trotman, 2015), there is still little research relating to internal GHG assurance. GRI guidelines evolved from G3 to G4 generation in May 2013 (Lokuwaduge & Heenetigala, 2016), but there is no particular study of G4 generation. This situation calls for an analysis of voluntary GHG disclosure via GRI G4 reports. In addition, as limited comparative analysis between the CDP and GRI is found in the reviewed literature, the practical value of previous study results cannot be determined. Thus, analysing differences between the CDP and GRI with respect to the quality of GHG disclosure is also required. Measuring GHG emissions is another critical issue for voluntary GHG reporting research. Based on limited samples, studies identify the measurement problems for GHG emissions, but rarely focus on Scope 3 GHG emissions. Therefore, future research should aim to examine and verify methods for measuring GHG emissions using large samples.

Significantly, the Outcome findings reveal the scarcity of studies on the outcomes of voluntary GHG reporting. Although some findings argue that voluntary GHG reporting is sufficient to

help stakeholders make better decisions (Jain et al., 2015), no study exists to support those findings.

Based on the process model of voluntary GHG reporting used in this study, this systematic literature review reveals the issues relevant to the debate around mandatory GHG reporting versus voluntary GHG reporting. The debate, as the main theme, is clouded by a lack of understanding of GHG information and reporting practices. Specifically, Australian organisations' current GHG reporting practices are primarily based on decisions around voluntary disclosure and, in the absence of specific accounting standards, most companies are flexible enough to experiment with reporting GHG information (Haigh & Shapiro, 2011). Under such circumstances, businesses can benefit from voluntary GHG reporting in many ways. Companies can improve their reputations and environmental stewardship by managing and reducing the negative effect of climate change (Olson, 2010). Companies are rewarded by investors with better financial outcomes for complying with environmental regulation (Kim & Lyon, 2011). External expectations for GHG disclosure encourage companies to establish and implement CMSs to mitigate GHG emissions and prepare GHG reporting (Tang & Luo, 2014). The enhanced CMSs can help companies manage the reputational risks imposed by regulations (Hogan & Lodhia, 2011). Further, voluntary GHG reporting can serve as a mechanism for businesses to legitimise themselves to obtain benefits, such as maintaining legal requirements, reducing information asymmetry, minimising capital costs and attracting more potential investors (e.g., Ben-Amar & McIlkenny, 2015; Prado-Lorenzo et al., 2009).

Comprehensively, researchers have reached the consensus that Australian voluntary GHG reporting suffers insufficient comparability, consistency and transparency within and across organisations because there are insufficient regulatory reporting regimes. Hrasky (2011) and Talbot and Boiral (2015) argue that Australian companies tend to employ impression management to engage in self-interested behaviour, portray a positive image and disclose insufficient GHG information. Some researchers (e.g., Green & Zhou, 2013; Olson, 2010) point out that Australian GHG assurance practices are unlikely to be functioning well to ensure the quality and reliability of GHG disclosure. In addition, voluntary GHG disclosure via the CDP and GRI lacks binding requirements and specific guidelines for sub-sectors, which results in self-select reporting (e.g., Lokuwaduge & Heenetigala, 2016; Matisoff et al., 2013). The Australian public sector operates in isolation, with respect to GHG reporting, that leads to low comparability and transparency (e.g., Adams et al., 2014; Sciulli, 2011). Therefore, agreeing

with the work of some researchers (e.g., Alrazi et al., 2016; Comyns, 2016), it could be argued that establishing ETS regulation may improve the quality and quantity of voluntary GHG reporting. Further, a regulatory framework for GHG reporting, mandatory guidelines for the specific contents of GHG reports (e.g., sub-sectors of industries, GHG assurance, measurement for GHG emissions) and collaborations within and among governments and organisations are necessary to achieve a trade-off between mandatory and voluntary GHG reporting.

5. Australian evidence provided by the content analysis

To identify consistencies and/or inconsistencies with the findings of the systematic literature review, this section provides the actual GHG reporting practices of six Australian entities. Based on the number of disclosures and any relevant documents prepared for the CDP, GRI and NGER reporting requirements, a classified list of GHG disclosure relating to governance and operational practices was developed to evaluate annual reports, sustainability reports and CDP reports.

Appendices 9, 10 and 11 summarise the GHG reporting practices of four Australian listed companies and two local government councils. Given the results of analysing the annual reports, sustainability reports and CDP reports, this section identifies two most important elements from those sources: a) the specific GHG issues disclosed by organisations show the drivers for voluntary GHG reporting—an organisation's voluntary GHG disclosure aims to meet stakeholder expectations (Issues 1, 2, 7), legitimise operations (Issue 10), reduce the agency problem (Issue 6), respond to institutional, regulatory and social expectations (Issues 1, 2, 7, 10) and promote senior managers' practices through financial incentives (Issue 8); b) the various GHG disclosures are analysed to determine whether GHG reporting practices are consistent and/or inconsistent with the reviewed articles.

5.1 GHG disclosure via annual reports

Appendix 9 gives an overview of GHG reporting practices using the 2013 annual reports of six Australian organisations. Based on the maximum score of 36, this study finds that ANZ (Registered, Financial) achieves the highest disclosure score of 26 (72%), whereas Bendigo and Adelaide Bank Limited (Non-registered, Financial) obtain the lowest disclosure score of 11 (31%). In addition, Rio Tinto Limited (Registered, Material) achieves a disclosure score of 25 (69%), Alumina Limited (Non-registered, Material) a score of 14 (39%), the City of Sydney Council (Public) a score of 21 (58%) and Blacktown City Council (Public) a score of 13 (36%).

The level of GHG disclosure varies considerably within and across Financial, Material and Public sectors. The major difference is in GHG emissions accounting. Compared with the other four organisations, ANZ and Rio Tinto Limited disclose relatively detailed and different GHG information and are subject to the disclosure requirements under the NGER Act 2007. Despite their detailed GHG information, ANZ and Rio Tinto Limited still provide a relatively low level of GHG disclosure. By contrast, the voluntary GHG disclosure of Bendigo and Adelaide Bank Limited and Alumina Limited is minimal and inconsistent. For the local government sector, voluntary GHG disclosure by the City of Sydney Council and Blacktown City Council is also low and inconsistent. The low disclosure scores support the findings of Sciulli (2011) that Australian local governments lack collaborations and mandatory guidelines to structure their climate change responses and enhance comparability.

This analysis, although not necessarily representative, supports the results of the systematic literature review that limited mandatory GHG reporting in Australia is insufficient to achieve comparable, consistent and transparent GHG reporting practices. This review of annual reports indicates that the voluntary GHG reporting practices of non-registered companies and local governments are limited and lack consistency, as these organisations select what GHG information to report.

5.2 GHG disclosure via sustainability reports

Four out of six organisations produce stand-alone sustainability reports; Bendigo and Adelaide Bank Limited (Non-registered, Financial) and Alumina Limited (Non-registered, Material) do not disclose their GHG information via sustainability reports. Appendix 10 summarises the results of voluntary GHG disclosure via sustainability report.

The maximum score is 36, and the results show that ANZ (Registered, Financial) achieves the highest disclosure score of 28 (78%), followed by Rio Tinto Limited (Registered, Material) with a disclosure score of 27 (75%). The disclosure scores of the Blacktown City Council (Public) and the City of Sydney Council (Public) are lower: 15 (42%) and 22 (61%), respectively.

Compared with the two local government councils, ANZ and Rio Tinto Limited provide more comprehensive GHG disclosure. Although ANZ and Rio Tinto Limited both comply with GRI G3 guidelines to report GHG issues, differences remain in their GHG emissions accounting. These differences suggest that the goal of consistency in GHG disclosure via GRI G3

guidelines is subject to limitations. It is noted that Rio Tinto Limited is the only company out of the four that discloses how it measures GHG emissions, reducing the comparability of the amount of GHG emissions within and across the Financial, Material and Public sectors. The two local government councils do not comply with GRI G3 guidelines, which is consistent with the findings of Adams et al. (2014). It was also found that, in contrast to the City of Sydney Council, Blacktown City Council does not disclose adequate information regarding GHG emissions accounting. This suggests that these two local government councils may have made different choices as to what to report; therefore, GHG disclosure lacks consistency and comparability within this sector.

5.3 GHG disclosure via CDP reports

Out of six organisations, only Blacktown City Council (Public) does not respond to the voluntary CDP program. In addition, except for City of Sydney Council (Public), the CDP reports of the other four organisations were scored to align with CDP's mission. Appendix 11 presents the results and CDP scores of GHG disclosure via CDP report.

Based on the maximum score of 36, this study finds that ANZ (Registered, Financial) obtains the highest disclosure score of 32 (89%), whereas Bendigo and Adelaide Bank Limited (Non-registered, Financial) have the lowest disclosure score of 21 (58%). Rio Tinto Limited (Registered, Material) scores 29 (81%), and Alumina Limited (Non-registered, Material) scores 23 (64%). City of Sydney Council (Public) achieves the disclosure score of 26 (72%). These results are consistent with their CDP scores that are awarded by the CDP questionnaire systems and that evaluate a response's 'the level of detail and comprehensiveness' (CDP, 2016b).

There are significant differences in GHG disclosure levels within and across the Financial, Material and Public sectors. ANZ's voluntary GHG disclosure via the CDP report is close to the best GHG reporting practice. Bendigo and Adelaide Bank Limited's voluntary GHG disclosure via the CDP report is fairly weak, because they do not disclose sufficient information relating to environmental management responsibility and engagement and GHG emissions accounting. Rio Tinto Limited's GHG reporting practices are relatively good, but Alumina Limited's GHG reporting practices are deficient, as they conceal some information regarding research and development and GHG emissions accounting. Moreover, for the two local government councils, only the City of Sydney Council voluntarily disclose GHG information

via the CDP report, but still lacks major information about GHG emissions accounting. Although five organisations disclose methodology to measure GHG emissions (Issue 13), they adopt various methods. Consequently, this is consistent with the arguments of Matisoff et al. (2013) that voluntary GHG disclosure via the CDP report lacks comparability, standardisation and consistency within and across different sectors.

5.4 Comparison of the annual reports, sustainability reports and CDP reports

From the results given in Appendix 9, 10 and 11, it is evident that organisations' GHG disclosure via their annual reports, stand-alone sustainability reports and CDP reports are likely to be generally consistent in their GHG reporting practices. For example, most organisations disclose some GHG issues in all reports, such as cognition via external engagement, GHG strategy and risk reduction, research and development, as well as GHG emissions accounting (e.g., issues 14, 17, 23, 26, 29). By contrast, some GHG issues are not reported by non-registered companies and local government councils, such as GHG emissions accounting (e.g., issues 19, 21, 22, 27, 30, 31). Notably, three issues are never disclosed by the six organisations examined, including the cost of GHG emissions, GHG removals and policies to help government and other stakeholders develop the carbon pricing and/or national ETS. However, there are four exceptions in which organisations disclose GHG issues, primarily in one report or two reports. They are discussed in this section.

Although six organisations produce annual reports, Bendigo and Adelaide Bank Limited (Non-registered, Financial) and Alumina Limited (Non-registered, Material) do not create stand-alone sustainability reports. Blacktown City Council (Public) does not generate its CDP reports, which is perhaps not surprising, because it has been argued that sustainability and CDP reporting lack binding requirements (e.g., Lokuwaduge & Heenetigala, 2016; Sciulli, 2011).

The GHG disclosure levels of four organisations (ANZ, Rio Tinto Limited, City of Sydney Council, Blacktown City Council) via sustainability reports are higher than via annual reports. Some GHG issues are disclosed by organisations' sustainability reports, yet are absent from their annual reports, such as GHG issues relating to board monitoring for GHG emissions (Issue 3), environmental management responsibility and engagement (Issue 5, 9), GHG emissions accounting (Issues 17, 18, 21, 25, 26, 30, 31) and benchmarks for GHG reporting (Issue 34). Similarly, there are a few GHG issues disclosed in annual reports rather than sustainability reports, such as board monitoring for GHG emissions (Issue 4) and benchmarks

for GHG reporting (Issue 32). This supports Mudd's (2010) argument that the GRI guidelines of sustainability reports improve the transparency of GHG disclosure. It may then be no surprise that GHG disclosure via sustainability reports is greater than via annual reports, particularly relating to the categories 'environmental management responsibility and engagement' and 'GHG emissions accounting'.

The GHG disclosure levels of five organisations (ANZ, Bendigo and Adelaide Bank Limited, Rio Tinto Limited, Alumina Limited, City of Sydney Council) via CDP reports are much higher than via annual reports, particularly in relation to board monitoring for GHG emissions (Issues 3, 4), GHG emissions accounting (Issues 13, 14, 17, 18, 21, 23, 25, 27, 29, 30, 31) and benchmarks for GHG reporting (Issues 32, 33, 34). Interestingly, all five organisations identify the Scope 3 GHG emissions. By contrast, a few issues are disclosed in annual reports rather than CDP reports, such as environmental management responsibility and engagement (Issues 5, 7, 9), and research and development (Issues 11, 12). This is not only consistent with Matisoff et al.'s (2013) argument that CDP reports promote Scope 3 GHG emissions, which mandatory GHG reporting does not address, but also suggests that CDP reports can improve the transparency of GHG disclosure.

The GHG disclosure levels of three organisations (ANZ, Rio Tinto Limited, City of Sydney Council) via CDP reports are relatively higher than via sustainability reports. Certain organisations publish some GHG issues in their CDP reports rather than sustainability reports, such as board monitoring for GHG emissions (Issue 4), GHG strategy and risk reduction (Issue 10), GHG emissions accounting (Issues 13, 18, 19, 27, 28, 30), benchmarks for GHG reporting (Issue 33) and carbon pricing and emission trading (Issue 36). Interestingly, all three organisations address a link between a manager's compensation and GHG mitigation targets. Some GHG issues are disclosed in sustainability reports instead of CDP reports, such as GHG performance measurement systems relating to GHG management and historical GHG emissions more than one year. This supports the argument of Cotter et al. (2011) that the extent of GHG disclosure via CDP reports is greater than via GRI G3 indicators of sustainability reports. Mainly, they relate to the categories 'board monitoring for GHG emissions', 'GHG strategy and risk reduction' 'GHG emissions accounting', 'benchmarks for GHG reporting' and 'carbon pricing and emission trading'.

In summary, apart from drivers addressed by the previous study, an additional driver is to promote senior managers' GHG practices through financial incentives. This implies that three

primary theories relating to financial incentives can be used to ground future empirical studies that investigate senior managers' performance and voluntary GHG disclosure: expectancy theory (Vroom, 1964), reinforcement theory (Komaki, Coombs, & Schepman, 1996) and goal-setting theory (Locke, Latham, & Erez, 1988), which address the positive relationship between financial incentives and GHG performance. Moreover, the voluntary GHG disclosure levels via CDP reports are higher than via the other two reports. This explains why previous researchers use more CDP reports as a secondary data source after 2011. Although Australia has a mandatory GHG reporting regime, overall, Australian voluntary GHG reporting lacks comparability and consistency within and across the Financial, Material and Public sectors, particularly in GHG emissions accounting. Voluntary GHG reporting of Australian non-registered companies and local governments remains low, whereas the voluntary GHG reporting practices of ANZ through the GRI and CDP are very close to the best reporting practices. This is consistent with the findings of Jain et al. (2015) that big Australian banks improve the transparency of GHG disclosure. Voluntary GHG reporting of Rio Tinto Limited through the GRI and CDP is not sufficient, and thus needs further improvement. Further, local governments lack collaborations to deal with voluntary GHG reporting. These situations imply that some specific mandatory guidelines for GHG disclosure should be designed for GHG emissions accounting (e.g., measurement of GHG emissions) to enhance comparability, consistency and transparency. Meanwhile, some mandatory reporting guidelines for the public sector may also need to be developed to ensure their leading role in facilitating social and environmental responsibilities. This, in turn, reflects the debate on the limitations of voluntary GHG reporting and potential benefits of sufficient mandatory GHG reporting requirements.

6. Suggesting a way forward—a comparison with Californian GHG reporting regimes

As evidenced in sections 4 and 5, voluntary GHG disclosure of Australian entities, particularly for non-registered companies and local governments that fall outside the scope of the NGER Act 2007, lacks comparability, consistency and transparency. This situation creates fierce debate on mandatory GHG reporting versus voluntary GHG reporting in Australia. The following comparative analysis with Californian GHG reporting regimes is a suggested way for Australia to address a trade-off between mandatory GHG reporting and voluntary GHG reporting to improve voluntary GHG disclosure.

California's reporting framework is similar to that of Australia, as both have mandatory and voluntary GHG reporting regimes. However, the state of California has established a relatively

comprehensive, collaborative and evaluative framework to design and operate a voluntary GHG reporting program under mandatory legislation. A framework can be developed from the Californian reporting regimes, as illustrated in Figure 6.

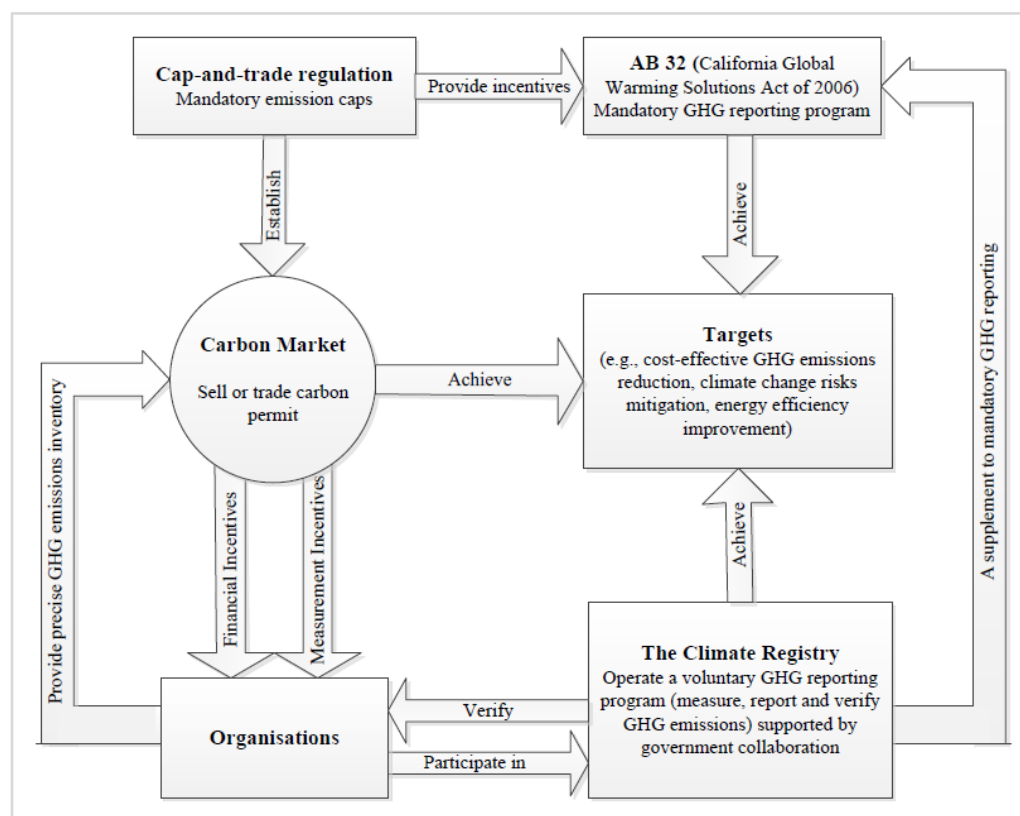


Figure 6: The framework of Californian voluntary GHG reporting under mandatory legislation

The state of California has established two main mandatory reporting regimes. In its toolbox of policy instrument strategies to mitigate the possible effects of global warming, California issued AB 32 to establish a mandatory GHG reporting program and enforce larger emitters to report their GHG emissions (California ARB, 2014). The AB 32 aims to achieve cost-effective GHG emissions reduction, climate change risk mitigation, energy efficiency improvement and environmental pollution protection.¹⁶ To provide incentives to achieve AB 32 targets, the California ARB designed a cap-and-trade regulation, the second largest ETS, which came into force on 1 January 2013. This market-based cap-and-trade regulation helps organisations minimise the compliance costs associated with achieving AB 32 targets.¹⁷ According to Livingston et al. (2015), this market-based regulation establishes a carbon market to sell or

¹⁶ The ARB must adopt AB 32 to achieve a set of goals (<https://www.arb.ca.gov/cc/ab32/ab32.htm>).

¹⁷ <https://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>

trade carbon permits. The carbon market provides measurement incentives for quantifying organisations' precise number of GHG emissions because it helps reduce their environmental burden and induce long-term economic savings (Livingston et al., 2015). The cap-and-trade regulation sets GHG emissions caps or limits for a carbon market that provides financial incentives to organisations to operate within limits. This supports the arguments of Luo and Tang (2015) in which ETS provides extra incentives for organisations to report GHG information voluntarily. The cap-and-trade regulation has financial implications across the entire economy through the carbon market, which in turn drives changes in how GHG emissions are priced and how organisations operate and consume energy and other resources (Tang & Luo, 2014).

During the implementation of mandatory emission caps, additional administrative responsibilities are imposed on regulators. They include the need to monitor GHG emissions and the requirement to establish a registry to keep track of GHG emission allowances (Goulder & Schein, 2013). Therefore, California incorporates elements from long-standing voluntary programs to achieve these administrative responsibilities. California selects TCR (former CCAR) as a central voluntary GHG program and a supplement to mandatory legislation to keep track of GHG emission allowances and oversee voluntary GHG reporting.¹⁸ According to Schneider (2013), TCR not only develops its own verification protocol under the International Organization for Standardization (ISO) 14065 to verify the GHG information of organisations that participate in the registry, but also expands the verification bodies to cover professional accounting firms. TCR facilitates the collaboration between US governments and works with organisations to create consistent and transparent GHG standards to calculate and report GHG emissions into a single registry (Livingston et al., 2015). TCR also assists local governments in achieving transparency and accountability for local climate actions, demonstrating leadership and initiating a process for direct access to global climate funds (Green, 2015). Further, TCR works with the Western Climate Initiative and therefore affects climate change policy (e.g., AB 32) by developing mandatory GHG reporting rules to achieve targets (Bernstein, Betsill, Hoffmann, & Paterson, 2010).

While the Californian voluntary GHG reporting works alongside an ETS; the Australian ETS was repealed in July 2014. Australian companies are not encouraged to cooperate with

¹⁸ TCR designs and operates voluntary GHG reporting programs (<https://www.theclimateregistry.org/who-we-are/about-us/>).

governments and other stakeholders to develop climate change policies relating to a national ETS or carbon pricing. Equally, the Australian local government sector is not encouraged to work together and collaborate with respect to voluntary GHG reporting. Without a national ETS in Australia, organisations have limited financial and measurement incentives, while regulators lack extra administrative responsibilities imposed by a carbon market, including overseeing organisations' GHG emissions and tracking their GHG emission allowances. Further, without collaborations within and among governments and organisations, integrating all GHG information through the registry of climate change actions, as well as developing consistent benchmarks and assessment mechanisms, it would appear impossible to establish an efficient and comprehensive framework to balance mandatory GHG reporting and voluntary GHG reporting (Chan et al., 2015). Therefore, applying a Californian-type voluntary GHG reporting scheme in Australia may require a mandatory national ETS and/or carbon pricing scheme to work alongside the NGER Act 2007 and achieve GHG reductions through an active carbon market. Under the stimulation of carbon market demands, Australia's local government sector may tightly collaborate with organisations to establish a voluntary program with consistent measurement and verification to monitor and operate an organisation's voluntary GHG reporting via a registry.

Recently, Australia considered moving to a market-based ETS. The Climate Change Authority recommends that an ETS would help align Australian climate change policies and obligations and meet GHG mitigation targets (Potter & Ludlow, 2016). Some Australian organisations, such as Origin Energy, called on the government to develop a national ETS, because this may provide incentives for investing in low-carbon electricity and winding down coal generation with high GHG emissions (AAP, 2017). In addition, the majority of Australian voters support an ETS for the electricity sector, while some major bodies, such as the Business Council of Australia and the National Farmers' Federation, have also called for adopting an ETS (Murphy, 2017). The success of California's GHG reporting system suggests that developing a national ETS would enhance collaboration among Australian governments, organisations and industry practitioners in developing a comprehensive, collaborative, evaluative and catalytic framework of voluntary GHG reporting programs under mandatory legislation (Chan et al., 2015). Further, in developing a national ETS, the Californian system may act as a suitable benchmark for Australia. This may help achieve the right balance between mandatory and voluntary GHG

reporting, leading to improved comparability, consistency and transparency of voluntary GHG disclosure.

7. Conclusions

This study has provided a systematic literature review of research relating to voluntary GHG reporting in Australia from 2008 to 2016. The evidence of voluntary GHG reporting practices from four Australian listed companies and two local government councils are consistent with that of previous studies analysed in the systematic literature review. Based on the analysis of existing literature and the GHG reporting practices of six entities, the Californian framework could offer an effective reference for Australia in designing an effective voluntary GHG reporting program.

The overall findings suggest an increasing trend in voluntary GHG discourse in Australia during the period of this analysis. This trend may result from organisations' increased understanding of the benefits of voluntary GHG reporting, such as improved reputation, better financial outcomes, reduced agency costs and competitive advantages. However, based on this study, the Australian experience shows that overall voluntary GHG reporting practices remain weak. In particular, voluntary GHG reporting practices by non-registered companies and local government councils appear to lack comparability, consistency and transparency. Although some GHG issues are well disclosed (e.g., cognition via external engagement, research and development), they fall behind the best reporting practices. The disclosure of some GHG issues (e.g., GHG emissions accounting) is very limited, resulting in questionable GHG disclosure quality. It could be argued that an insufficient regulatory framework exists for GHG performance, comparability, reliability and collaborations for developing a consistent GHG assessment and verification mechanism. Therefore, the findings present an ongoing debate about mandatory versus voluntary GHG reporting to achieve consistency, comparability and transparency.

This research has explored and explained the Californian voluntary GHG reporting program based on mandatory legislation. The Californian program uses a relatively successful framework to balance mandatory GHG reporting and voluntary GHG reporting, and to achieve collaboration between local governments, organisations and practitioners. Although Australia currently has no national ETS, this framework may still be used as a way forward for Australian local governments, organisations and practitioners to design and operate a voluntary GHG

reporting program. As discussed previously, organisations are expected to increase the quality of voluntary GHG disclosure to meet increasing stakeholder expectations. However, organisations may struggle with how to improve the comparability and consistency of their GHG disclosure because of the various GHG measurements and insufficient GHG guidelines. As a result, it can be anticipated that the collaboration evident in the Californian framework would be a useful reference for Australian local governments, organisations and industry practitioners to cooperate by sharing experiences and ideas to develop an effective voluntary GHG reporting regime with a consistent GHG measurement and verification system. This would help to achieve a trade-off between mandatory and voluntary GHG reporting to improve the comparability, consistency and transparency of voluntary GHG disclosure in Australia.

The classified list of GHG reporting practices developed in this study would be a useful benchmark for local governments, organisations and industry practitioners to design an effective voluntary GHG reporting program, and would assist non-registered companies and local government councils with comprehensively reporting GHG issues to gain competitive advantages in certain areas. This research would help various stakeholders evaluate organisations' accountability in relation to GHG mitigation activities. Further, this research could offer government policymakers insights into the debate on mandatory versus voluntary GHG reporting in Australia, and give weight to arguments that designing and operating voluntary GHG reporting programs involving collaborations and an active carbon market may be necessary to achieve high-quality GHG disclosure.

This study is not without limitations. A period of nine years for the selected literature represents a substantial bias, because there may be some relevant articles published before 2008. GHG disclosure is scored when related GHG information is mentioned or exists in the reports without considering the extent of explanations or discussions. The organisations' GHG reporting practices analysed constitute a small sample size, and the generalisation of findings should be exercised with caution. Meanwhile, the analysis relies on disclosed GHG information in the reports to reflect actual GHG actions and drivers. This may generate potential bias, because Daub (2007) argues that organisations are likely to publish their reports using graphics and terminology to portray a positive image for their activities. Future research can obtain direct information about GHG actions and drivers through interviews with directors, senior managers or internal auditors. Although the framework of the California voluntary GHG reporting program is used as a reference, the framework itself and its relevant legislation (e.g.,

ETS) is specific to California and may not be appropriate in the Australian environment. Further research should investigate how the ETS influence voluntary GHG reporting would significantly contribute to the development of a voluntary GHG reporting program in Australia.

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Appendixes

Appendix 1: The list of 62 peer-reviewed journal articles

Journal	ABDC	SJR	Origin	Journal Year	Total Number of Articles
Abacus: A Journal of Accounting, Finance and Business Studies	A			1965	1
Accounting and Business Research	A	Q2	United Kingdom	1970	2
Accounting and Finance	A	Q1	Australia	1960	2
Accounting Auditing and Accountability Journal	A			1988	8
Accounting Horizons	A	Q1	United States	1987	1
Australasian Journal of Environmental Management	A	Q2	United Kingdom	1994	3
Australian Journal of Management	A	Q1	United Kingdom	1976	1
Business and Politics	A	Q2	United Kingdom	1999	1
Business and Society	A	Q1	United Kingdom	1960	1
Energy Policy	A	Q1	United Kingdom	1973	1
International Journal of Accounting Information Systems	A	Q1	United States	2000	1
Journal of Business Ethics	A	Q1	Netherlands	1982	4
Journal of Contemporary Accounting and Economics	A	Q3	Netherlands	2005	1
Journal of Environmental Management	A	Q1	United States	1973	1
Journal of International Accounting Research	A	Q2	United States	2002	1
The BE Journal of Economic Analysis and Policy	A			2001	1
The International Journal of Accounting	A			1965	1
Auditing: A Journal of Practice and Theory	A*			1981	2
The European Accounting Review	A*			1992	1
Accounting Forum	B	Q2	Australia	1978	1
Australian Accounting Review	B	Q2	United Kingdom	1991	4
Business Strategy and the Environment	B	Q1	United Kingdom	1992	4
Development Policy Review	B	Q1	United Kingdom	1966	1
Journal of Environmental Planning and Management	B	Q1	United Kingdom	1948	1
Journal of International Financial Management and Accounting	B	Q2	United Kingdom	1988	1
Management Decision	B	Q1	United Kingdom	1967	1
Managerial Auditing Journal	B	Q2	United Kingdom	1986	3
Qualitative Research in Accounting and Management	B	Q2	United Kingdom	2004	1
Resources Policy	B	Q1	United Kingdom	1974	1
Social Responsibility Journal	B	Q2	United Kingdom	2004	1
Sustainability Accounting, Management and Policy Journal	B	Q2	United Kingdom	2010	3
Corporate Social Responsibility and Environmental Management	C	Q1	United Kingdom	1994	3
Sustainable Development	C	Q1	United Kingdom	1993	3
Grand Total					62

Appendix 2: The availability of six Australian entities' annual, sustainability and CDP reports

	Name	2013		
		Annual report	Sustainability report	CDP report
Registered companies	ANZ (Financial)	√	√	√
	Rio Tinto Limited (Material)	√	√	√
Non-registered companies	Bendigo & Adelaide Bank Limited (Financial)	√	×	√
	Alumina Limited (Material)	√	×	√
Local government councils	City of Sydney Council (Public)	√	√	√
	Blacktown City Council (Public)	√	√	×
Total		6	4	5
Note: √ = Available; × = Unavailable				

Appendix 3: The classified list of GHG disclosure relating to governance and operational practices

Key GHG issues		Specific GHG issues
Input	Cognition via external engagement	1. Does the entity have policies to undertake climate change education and/or training to promote GHG behaviour in public?
		2. Does the entity have policies to cooperate with government in voluntary GHG mitigation programs to combat climate change?
Process	Board monitoring for GHG emissions	3. Does the entity have a board committee to discharge monitoring responsibility for GHG performance and activities?
		4. Does the board discharge responsibility for periodically reviewing GHG performance and activities?
	Environmental management responsibility & engagement	5. Does a CEO or a Chairman express views on GHG issues via various reports or corporate websites?
		6. Does the entity have a risk management team to manage GHG risks and opportunities?
		7. Does the entity have media, community and relation with government to concentrate on GHG issues?
		8. Does senior managers and/or officers compensation link to GHG mitigation targets?
		9. Does the entity have GHG performance measurement systems relating to GHG management?
	GHG strategy & risk reduction	10. Does the entity develop GHG strategies to minimise potential regulatory risks (e.g., growing compliance costs) and/or physical risks (e.g., business disruptions) relating to GHG emissions?
	Research & development	11. Does the entity have specific policies to develop energy efficiency through acquisition or use of low GHG emissions technologies?
		12. Does the entity have investment policies to develop technologies for generating low GHG emissions and reducing energy use?
Output	GHG emissions accounting	13. Does the entity disclose how to measure GHG emissions (scope 1 and 2 GHG emissions)?
		14. Does the entity identify amount and/or intensity of GHG emissions?
		15. Does the entity identify change amount and/or change intensity of GHG emissions?
		16. Does the entity identify cost of GHG emissions?
		17. Does the entity identify GHG reduction initiatives relating to energy saving?
		18. Does the entity identify scope 3 emissions?
		19. Does the entity identify invested amount (\$) to reduce GHG emissions?
		20. Does the entity identify GHG removals?
		21. Does the entity calculate GHG emissions savings and offsets?
		22. Does the entity provide GHG emission reduction targets for the next year?
		23. Does the entity identify total GHG emissions inventory annually?
		24. Does the entity provide historical GHG emissions more than one year?
		25. Does the entity set base year for estimating future GHG emissions?
		26. Does the entity set GHG mitigation targets for products and/or facilities?
		27. Does the entity have external auditors to assure GHG data?
		28. Does the entity have internal auditors to assure GHG data?
		29. Does the entity have specific policies to buy and/or use renewable energy sources?
		30. Does the entity require suppliers to mitigate GHG emissions relating to their GHG performance and operation?
		31. Does the entity have a policy of supply relating to provide GHG emissions mitigation information through product labelling?
	Benchmarks for GHG reporting	32. Does the entity have specific frameworks for benchmarking GHG emissions against competitors?
		33. Does the entity have specific policies to comply with GRI and/or GHG protocol to disclose GHG emissions?
34. Does the entity have specific policies to comply with CDP to report GHG emissions?		
Carbon pricing & emission trading	35. Does the entity have policies to help government and other stakeholders to develop carbon pricing and/or national ETS?	
	36. Does the entity have policies to trade in international ETS (e.g., EU ETS)?	
Total score		36

Appendix 4: Theories for voluntary GHG reporting research

Theories for Voluntary GHG Reporting	Consistent	Inconsistent
Voluntary disclosure theory (Signalling theory)	Cotter, Najah, and Wang (2011) Gallego-Álvarez (2012) Luo and Tang (2014) Oates and Moradi-Motlagh (2016) Guenther, Guenther, Schiemann, and Weber (2016)	Clarkson, Overell, and Chapple (2011) Kim and Lyon (2011) Sutantoputra, Lindorff, and Johnson (2012) Ortas, Gallego-Alvarez, and Álvarez Etxeberria (2015)
Socio-political theories (Stakeholder theory & Legitimacy theory)	Prado-Lorenzo and García-Sánchez (2010) Clarkson, Overell, and Chapple (2011) Lokuwaduge and Heenetigala (2016)	
Stakeholder theory	Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Álvarez, and García-Sánchez (2009) Sprengel and Busch (2011) Cotter and Najah (2012) Guenther, Guenther, Schiemann, and Weber (2016)	
Legitimacy theory	Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Álvarez, and García-Sánchez (2009) Cuganesan, Guthrie, and Ward (2010) Hrasky (2011) Cowan and Deegan (2011) Sciulli (2011) Luo, Lan, and Tang (2012) Sutantoputra, Lindorff, and Johnson (2012) Ortas, Gallego-Alvarez, and Álvarez Etxeberria (2015) Comyns and Figge (2015) Yunus, Eljido-Ten, and Abhayawansa (2016)	Alrazi, De Villiers, and Van Staden (2016)
Institutional theory	Luo, Lan, and Tang (2012) Haque and Islam (2015) Trotman and Trotman (2015) Luo and Tang (2016) Comyns (2016)	
Agency theory	Ortas, Gallego-Alvarez, and Álvarez Etxeberria (2015) Jung, Herbohn, and Clarkson (2016)	Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Álvarez, and García-Sánchez (2009) Anran, Periasamy, and Zulkafli (2014) Trotman and Trotman (2015)
Political costs theory	Ortas, Gallego-Alvarez, and Álvarez Etxeberria (2015)	
Proprietary costs theory	Prado-Lorenzo and García-Sánchez (2010)	
Institutional governance system theory	Rankin, Windsor, and Wahyuni (2011)	
Reputation risk management (RRM) theory	Hogan and Lodhia (2011)	
Resource dependence theory	Trotman and Trotman (2015)	
Bourdieu' theory of practice	Lodhia and Jacobs (2013)	

Appendix 5: Research on determinants of voluntary GHG reporting

Authors (year)	Population & sample	Dependent Variables	Determinants on extent, quality & adoption of voluntary GHG reporting																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
			Firm size	MTOB	Economic determinants						Sustainability performance		Board function						Industry sensitivity & institutional macro-context				Forms	Hofstede culture dimensions					Non-financial stakeholders																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
					ROE	ROA	Leverage	Stock price volatility	Tobin Q	Capital intensity	GHG performance	Asset newness	Corporate environment committee	Corporate governance quality	Independence	Duality	size	Diversity	Intensive industry	Legal enforcement	EU ETS	Kyoto Protocol		GRI	CDP	MAS	PD	UA	IND	LTO	GHG politics	General public	Media	Employee	Customer																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Álvarez, and García-Sánchez (2009)	Fortune 500 / 101 (e.g., AU firms)	Extent	+	+	---	0	0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				</

Note: + means a positively significant relationship; – means a negatively significant relationship; sig. means a significant relationship but no clear direction; 0 means no significant relationship.

Appendix 6: Assurance on voluntary GHG reporting

Authors (year)	Research Method	Assurance Type	Before ISAE 3000 (Revised) & ISAE 3410	After ISAE 3000 (Revised) & ISAE 3410	Main findings & conclusions
Hodge, Subramaniam, and Stewart (2009)	Experiment	External	√		Necessary to develop appropriate assurance guidelines and standards to enhance credibility and consistency of GHG disclosure.
Simnett, Nugent, and Huggins (2009)	Commentary / Normative study	External	√		Require a particular international assurance standard covering various monitoring methodologies on GHG reporting.
Olson (2010)	Commentary / Normative study	External	√		Lack global standards relating to competencies required by GHG reporting or assurance of GHG reports.
Milne and Grubnic (2011)	Commentary / Normative study	External	√		Difficult to accounting GHG emissions owing to uncertain and complex estimation methods.
Green and Li (2011)	Survey	External	√		Require new GHG assurance standards to minimise potential expectation gaps, develop specific definitions and criteria for GHG emissions, and consider mechanisms to ensure assurance is communicated to users.
Green and Zhou (2013)	Quantitative Content Analysis	External	√		Necessary to establish an acknowledged regulatory framework to ensure the quality of GHG disclosure and comparability of GHG information across different jurisdictions.
Trotman and Trotman (2015)	Interview	Internal		√	Major factors (e.g., potential penalties) that significantly determine internal audit involvement need further experimental examination.
Zhou, Simnett, and Green (2016)	Model	External		√	Country-level and company-level factors can affect company's decisions on whether to purchase external GHG assurance.
Bepari and Mollik (2016)	Quantitative Content analysis	External		√	Australian GHG assurance practices are not considered an accountability enabler - a lack of stakeholders engagement, limitation of performance indicator selection, reluctance to address assurance statements to various stakeholders.

Appendix 7: Forms used for voluntary GHG reporting

Authors (year)	CDP		GRI		CDSB
	For	Against	For	Against	For
Kolk, Levy, and Pinkse (2008)	CDP signatories that do not impose requirements attract more potential investors.	Lack consistency, details, reliable inspection and valuable GHG information.			
Cuganesan, Guthrie, and Ward (2010)				One-size-fits-all. Lack specific GHG guidelines for the sub-sector of a industry.	
Mudd (2010)			Continually improve clarity and transparency of GHG disclosure.	Need improvement in consistency.	
Cotter, Najah, and Wang (2011)	The extent of GHG disclosure in CDP reports are higher than in GRI reports. Can complement to GRI reports to communicate large investors.	Be constrained by registration. Users are hard and inconsistent to interpret CDP data because of insufficient commensuration.		Select to report. Scope of GRI indicators is too broader to report GHG emissions and facilitate the inclusion of all GHG information.	Align with qualitative characteristics of IASB Conceptual Framework to make useful decisions.
Sciulli (2011)				GRI indicators are voluntary. Lack comparability of GHG disclosure.	
Matisoff, Noonan, and O'Brien (2013)	Promote disclosure of scope 2 and scope 3 emissions (exclude from mandatory reporting). Begin to grade companies based on the quality of responses.	Lack uniformity, comparability and standardisation of GHG disclosure across companies.			
Alonso-Almeida, Llach, and Marimon (2014)			Increase visibility of capital market. Evolve from G3 to G4 to enhance relevance and comparability.	Lack specific sector guidelines and flexibility to address various sectors' perspectives on GHG issues.	
Siew (2015)		GHG disclosure scores do not judge GHG performance.		GHG disclosure levels (A, B and C) depend on a company's choice.	
Linnenluecke, Birt, and Griffiths (2015)	Provide disclosure and performance scores to access the level of GHG activities.		Cooperate with CDP to ensure consistent guidelines and indicators for voluntary GHG reporting.		Align with IASB and provide risks and opportunities of GHG information for shareholders' value in annual reports.
Lokuwaduge and Heenetigala (2016)				Do not provide performance of strategies for GHG mitigation.. Select GRI indicators to report GHG issues (Lack comparability).	

Appendix 8: Reporting practice relating to the quantity and quality of GHG information

Authors (year)	Sample	Main findings & conclusions	For whom
Haque and Deegan (2010)	5 Australia companies / S&P ASX 100	Using an absence of GHG accounting standards as an excuse. Low GHG reporting practices. Quality is questionable.	Investors & other stakeholders
Dong and Burritt (2010)	25 Australian oil & gas firms / ASX 300	Voluntary GHG disclosure is relative poor. Do not comply with voluntary industry benchmarks.	Investors
M. Haigh and Shapiro (2011)	30 interviews in financial sectors / e.g., Australia	Various measures and calculation methods. Lack of comparability. Provide imaginary, symbolic and nebulous GHG information.	Financial investors
Nelson, Wood, Hunt, and Thurbon (2011)	Financial analyst research / Australian GHG reporting	Disclose insufficient and less useful GHG information (e.g., scope 1 & 2 GHG emissions). Need consistent calculation methods to enhance comparability across companies.	Investors
Downie and Stubbs (2012)	19 interviews / 22 Australian organisations	Lack mandatory conversion information to translate financial expenses into CO ₂ -e. Voluntary GHG disclosure is various in quantity and poor in quality across organisations.	Internal & external stakeholders
Burritt (2012)	Environmental performance accountability / AAAJ	Practitioners and researchers do not interface with each other. Lack an agreement over standard method to measure GHG emissions.	Internal & external stakeholders
Adams, Muir, and Hoque (2014)	Australian governments (e.g., Federal, State)	Voluntary GHG reporting appears to be low. Unlikely to adopt GRI guidelines. In a non-competitive environment.	Internal & external stakeholders
Comyns and Figge (2015)	45 oil & gas firms (e.g., Australia)	“Search” information (e.g., be rewarded) is sufficient for voluntary GHG disclosure. Cannot produce high quality GHG disclosure.	Internal & external stakeholders
Haque and Islam (2015)	50 Australian financial & non-financial stakeholders	Companies are unlikely to report GHG information until non-financial stakeholders (e.g., non-government organisations, governments and media) put pressure on them.	Different stakeholders group
Haque, Deegan, and Inglis (2016)	50 stakeholders from Australian energy-intensive companies	Companies fall outside the best GHG reporting practices and disclose less GHG information. No expectations from powerful stakeholders (e.g. governments) make companies to disclose more GHG information. Lack stakeholder engagement.	A broad cross-section of stakeholders

Appendix 9: GHG disclosure via 2013 annual reports

Key GHG issues		Specific GHG issues	ANZ	Bendigo & Adelaide Bank Limited	Rio Tinto Limited	Alumina Limited	City of Sydney Council	Blacktown City Council	
Input	Cognition via external engagement	1. Does the entity have policies to undertake climate change education and/or training to promote GHG behaviour in public?	1	1	1	1	1	1	
		2. Does the entity have policies to cooperate with government in voluntary GHG mitigation programs to combat climate change?	1	1	1	1	1	1	
Process	Board monitoring for GHG emissions	3. Does the entity have a board committee to discharge monitoring responsibility for GHG performance and activities?	0	0	1	0	0	0	
		4. Does the board discharge responsibility for periodically reviewing GHG performance and activities?	1	0	1	0	1	0	
	Environmental management responsibility & engagement	5. Does a CEO or a Chairman express views on GHG issues via various reports or corporate websites?	1	0	0	1	1	0	
		6. Does the entity have a risk management team to manage GHG risks and opportunities?	1	1	1	1	1	1	
		7. Does the entity have media, community and relation with government to concentrate on GHG issues?	1	1	1	1	1	1	
		8. Does senior managers and/or officers compensation link to GHG mitigation targets?	0	0	0	0	0	0	
		9. Does the entity have GHG performance measurement systems relating to GHG management?	1	0	1	1	1	0	
	GHG strategy & risk reduction	10. Does the entity develop GHG strategies to minimise potential regulatory risks (e.g., growing compliance costs) and/or physical risks (e.g., business disruptions) relating to GHG emissions?	1	1	1	1	1	0	
	Research & development	11. Does the entity have specific policies to develop energy efficiency through acquisition or use of low GHG emissions technologies?	1	1	1	1	1	1	
		12. Does the entity have investment policies to develop technologies for generating low GHG emissions and reducing energy use?	1	1	1	1	1	1	
Output	GHG emissions accounting	13. Does the entity disclose how to measure GHG emissions (scope 1 and 2 GHG emissions)?	0	0	1	0	0	0	
		14. Does the entity identify amount and/or intensity of GHG emissions?	1	0	1	0	1	1	
		15. Does the entity identify change amount and/or change intensity of GHG emissions?	1	0	1	0	1	1	
		16. Does the entity identify cost of GHG emissions?	0	0	0	0	0	0	
		17. Does the entity identify GHG reduction initiatives relating to energy saving?	1	1	1	1	0	1	
		18. Does the entity identify scope 3 emissions?	0	0	0	0	0	0	
		19. Does the entity identify invested amount (\$) to reduce GHG emissions?	1	0	1	0	1	0	
		20. Does the entity identify GHG removals?	0	0	0	0	0	0	
		21. Does the entity calculate GHG emissions savings and offsets?	1	1	0	0	0	0	
		22. Does the entity provide GHG emission reduction targets for the next year?	1	0	1	0	1	0	
		23. Does the entity identify total GHG emissions inventory annually?	1	0	1	0	1	1	
		24. Does the entity provide historical GHG emissions more than one year?	1	0	1	0	1	1	
		25. Does the entity set base year for estimating future GHG emissions?	0	0	1	0	1	0	
		26. Does the entity set GHG mitigation targets for products and/or facilities?	1	0	1	1	1	0	
		27. Does the entity have external auditors to assure GHG data?	1	0	1	0	0	0	
		28. Does the entity have internal auditors to assure GHG data?	1	0	1	1	1	0	
		29. Does the entity have specific policies to buy and/or use renewable energy sources?	1	1	1	0	1	1	
		30. Does the entity require suppliers to mitigate GHG emissions relating to their GHG performance and operation?	1	0	0	0	0	0	
		31. Does the entity have a policy of supply relating to provide GHG emissions mitigation information through product labelling?	0	1	0	0	0	0	
		Benchmarks for GHG reporting	32. Does the entity have specific frameworks for benchmarking GHG emissions against competitors?	1	0	1	1	1	1
	33. Does the entity have specific policies to comply with GRI and/or GHG protocol to disclose GHG emissions?		1	0	1	1	0	0	
	34. Does the entity have specific policies to comply with CDP to report GHG emissions?		1	0	0	0	0	0	
	Carbon pricing & emission trading	35. Does the entity have policies to help government and other stakeholders to develop carbon pricing and/or national ETS?	0	0	0	0	0	0	
		36. Does the entity have policies to trade in international ETS (e.g., EU ETS)?	0	0	0	0	0	0	
	Total score			26	11	25	14	21	13

Appendix 10: GHG disclosure via 2013 sustainability reports

Key GHG issues		Specific GHG issues	ANZ	Bendigo & Adelaide Bank Limited	Rio Tinto Limited	Alumina Limited	City of Sydney Council	Blacktown City Council
Input	Cognition via external engagement	1. Does the entity have policies to undertake climate change education and/or training to promote GHG behaviour in public?	1	×	0	×	1	1
		2. Does the entity have policies to cooperate with government in voluntary GHG mitigation programs to combat climate change?	1		1		1	
Process	Board monitoring for GHG emissions	3. Does the entity have a board committee to discharge monitoring responsibility for GHG performance and activities?	1		1		0	0
		4. Does the board discharge responsibility for periodically reviewing GHG performance and activities?	1		1		0	0
	Environmental management responsibility & engagement	5. Does a CEO or a Chairman express views on GHG issues via various reports or corporate websites?	1		1		1	0
		6. Does the entity have a risk management team to manage GHG risks and opportunities?	1		1		1	1
		7. Does the entity have media, community and relation with government to concentrate on GHG issues?	1		1		1	1
		8. Does senior managers and/or officers compensation link to GHG mitigation targets?	0		0		0	0
		9. Does the entity have GHG performance measurement systems relating to GHG management?	1		1		1	1
	GHG strategy & risk reduction	10. Does the entity develop GHG strategies to minimise potential regulatory risks (e.g., growing compliance costs) and/or physical risks (e.g., business disruptions) relating to GHG emissions?	1		1		0	0
	Research & development	11. Does the entity have specific policies to develop energy efficiency through acquisition or use of low GHG emissions technologies?	1		1		1	1
		12. Does the entity have investment policies to develop technologies for generating low GHG emissions and reducing energy use?	1		1		1	1
Output	GHG emissions accounting	13. Does the entity disclose how to measure GHG emissions (scope 1 and 2 GHG emissions)?	0		1		0	0
		14. Does the entity identify amount and/or intensity of GHG emissions?	1		1		1	1
		15. Does the entity identify change amount and/or change intensity of GHG emissions?	1		1		1	1
		16. Does the entity identify cost of GHG emissions?	0		0		0	0
		17. Does the entity identify GHG reduction initiatives relating to energy saving?	1		1		1	1
		18. Does the entity identify scope 3 emissions?	0		0		1	0
		19. Does the entity identify invested amount (\$) to reduce GHG emissions?	1		0		1	0
		20. Does the entity identify GHG removals?	0		0		0	0
		21. Does the entity calculate GHG emissions savings and offsets?	1		0		1	0
		22. Does the entity provide GHG emission reduction targets for the next year?	1		1		1	0
		23. Does the entity identify total GHG emissions inventory annually?	1		1		1	1
		24. Does the entity provide historical GHG emissions more than one year?	1		1		1	1
		25. Does the entity set base year for estimating future GHG emissions?	1		1		1	0
		26. Does the entity set GHG mitigation targets for products and/or facilities?	1		1		1	1
		27. Does the entity have external auditors to assure GHG data?	1		1		0	0
		28. Does the entity have internal auditors to assure GHG data?	1		1		0	0
		29. Does the entity have specific policies to buy and/or use renewable energy sources?	1		1		1	1
		30. Does the entity require suppliers to mitigate GHG emissions relating to their GHG performance and operation?	1		1		0	0
		31. Does the entity have a policy of supply relating to provide GHG emissions mitigation information through product labelling?	0		1		0	1
	Benchmarks for GHG reporting	32. Does the entity have specific frameworks for benchmarking GHG emissions against competitors?	1		1		1	0
		33. Does the entity have specific policies to comply with GRI and/or GHG protocol to disclose GHG emissions?	1		1		0	0
		34. Does the entity have specific policies to comply with CDP to report GHG emissions?	1		1		1	0
	Carbon pricing & emission trading	35. Does the entity have policies to help government and other stakeholders to develop carbon pricing and/or national ETS?	0		0		0	0
		36. Does the entity have policies to trade in international ETS (e.g., EU ETS)?	0		0		0	0
Total score			28		27		22	15

Appendix 11: GHG disclosure via 2013 CDP reports

Key GHG issues		Specific GHG issues	ANZ	Bendigo & Adelaide Bank Limited	Rio Tinto Limited	Alumina Limited	City of Sydney Council	Blacktown City Council	
Input	Cognition via external engagement	1. Does the entity have policies to undertake climate change education and/or training to promote GHG behaviour in public?	1	1	0	0	1	×	
		2. Does the entity have policies to cooperate with government in voluntary GHG mitigation programs to combat climate change?	1	1	1	1	1		
Process	Board monitoring for GHG emissions	3. Does the entity have a board committee to discharge monitoring responsibility for GHG performance and activities?	1	1	1	1	0		
		4. Does the board discharge responsibility for periodically reviewing GHG performance and activities?	1	1	1	1	1		
	Environmental management responsibility & engagement	5. Does a CEO or a Chairman express views on GHG issues via various reports or corporate websites?	1	0	0	0	1		
		6. Does the entity have a risk management team to manage GHG risks and opportunities?	1	1	1	1	1		
		7. Does the entity have media, community and relation with government to concentrate on GHG issues?	1	0	1	1	1		
		8. Does senior managers and/or officers compensation link to GHG mitigation targets?	1	0	1	1	1		
		9. Does the entity have GHG performance measurement systems relating to GHG management?	1	0	1	1	0		
	GHG strategy & risk reduction	10. Does the entity develop GHG strategies to minimise potential regulatory risks (e.g., growing compliance costs) and/or physical risks (e.g., business disruptions) relating to GHG emissions?	1	1	1	1	1		
	Research & development	11. Does the entity have specific policies to develop energy efficiency through acquisition or use of low GHG emissions technologies?	1	1	1	0	1		
		12. Does the entity have investment policies to develop technologies for generating low GHG emissions and reducing energy use?	1	1	1	0	1		
Output	GHG emissions accounting	13. Does the entity disclose how to measure GHG emissions (scope 1 and 2 GHG emissions)?	1	1	1	1	1		
		14. Does the entity identify amount and/or intensity of GHG emissions?	1	1	1	1	1		
		15. Does the entity identify change amount and/or change intensity of GHG emissions?	1	0	1	1	0		
		16. Does the entity identify cost of GHG emissions?	0	0	0	0	0		
		17. Does the entity identify GHG reduction initiatives relating to energy saving?	1	1	1	1	1		
		18. Does the entity identify scope 3 emissions?	1	1	1	1	1		
		19. Does the entity identify invested amount (\$) to reduce GHG emissions?	1	0	1	0	1		
		20. Does the entity identify GHG removals?	0	0	0	0	0		
		21. Does the entity calculate GHG emissions savings and offsets?	1	1	1	0	0		
		22. Does the entity provide GHG emission reduction targets for the next year?	1	0	1	0	1		
		23. Does the entity identify total GHG emissions inventory annually?	1	1	1	1	1		
		24. Does the entity provide historical GHG emissions more than one year?	0	0	0	0	0		
		25. Does the entity set base year for estimating future GHG emissions?	1	1	1	1	1		
		26. Does the entity set GHG mitigation targets for products and/or facilities?	1	0	1	1	1		
		27. Does the entity have external auditors to assure GHG data?	1	0	1	1	1		
		28. Does the entity have internal auditors to assure GHG data?	1	1	1	0	1		
		29. Does the entity have specific policies to buy and/or use renewable energy sources?	1	1	1	1	1		
		30. Does the entity require suppliers to mitigate GHG emissions relating to their GHG performance and operation?	1	0	1	1	1		
		31. Does the entity have a policy of supply relating to provide GHG emissions mitigation information through product labelling?	1	1	0	0	0		
		Benchmarks for GHG reporting	32. Does the entity have specific frameworks for benchmarking GHG emissions against competitors?	1	1	1	1		1
	33. Does the entity have specific policies to comply with GRI and/or GHG protocol to disclose GHG emissions?		1	1	1	1	1		
	34. Does the entity have specific policies to comply with CDP to report GHG emissions?		1	1	1	1	1		
	Carbon pricing & emission trading	35. Does the entity have policies to help government and other stakeholders to develop carbon pricing and/or national ETS?	0	0	0	0	0		
		36. Does the entity have policies to trade in international ETS (e.g., EU ETS)?	1	0	1	1	0		
	Total score			32	21	29	23		26
	CDP score			A- 92	D 68	B 88	C 72		×