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FRAMING OF CLIMATE CHANGE IMPACTS AND USE OF MANAGEMENT ACCOUNTING PRACTICES

Jayanthi Kumarasiri[1]* and Christine Jubb[2]

[1]Faculty of Business and Law, Swinburne University of Technology, PO Box 218 Hawthorn VIC 3122 Australia
[2]Centre for Transformative Innovation, Faculty of Business and Law, Swinburne University of Technology, PO Box 218 Hawthorn VIC 3122 Australia

*Corresponding author: jkumarasiri@swin.edu.au

ABSTRACT

This study examines (i) how companies perceive climate change impacts in terms of opportunities or threats and the reasons for these perceptions, and (ii) use of management accounting practices to manage carbon emissions and the relationship between climate change perceptions and accounting use. The sample consists of Australian companies that participated in the Carbon Disclosure Project (CDP) 2009 survey. We find that how climate change impacts are framed (as threat or opportunity) influences the use of planning and target setting, performance measurement and incentivisation in managing emissions. However, in general, use of accounting practices in managing carbon emissions is limited.

Keywords: climate change, carbon emissions, management accounting, prospect theory

INTRODUCTION

Climate change issues are one of the major challenges faced by modern companies (Solomon, Solomon, Norton, & Joseph, 2011; Subramaniam, Wahyuni, Cooper, Leung, & Wines, 2015). Strategic decision-making on environmental issues brings many challenges to managers within these companies, especially due to the uncertainty and complexity surrounding these issues (Lee & Klassen, 2015). Although there is research in relation to management accounting practices

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that facilitate provision of environmental information for managers (Burritt, Schaltegger, & Zvezdov, 2011; Subramaniam et al., 2015), far less is known about accounting practices used in relation to environmental issues surrounding carbon emissions. Hartmann, Perego and Young (2013) argue that a disproportionate focus on examining carbon disclosures, the absence of academic debate from a management accounting and control perspective, together with few empirical studies, are responsible for a lack of clarity in this area. As such, we respond to calls stressing the importance of research that investigates management practices used by companies in mitigating carbon emission issues (Burritt et al., 2011; Milne & Grubnic, 2011).

We analyse company information reported through the Carbon Disclosure Project (CDP), a publicly available global database containing annual survey responses by companies about their carbon emissions and climate change-related perceptions and actions. Our purpose is to answer two research questions. First, how do companies frame climate change impacts – that is, how do they perceive climate change in terms of opportunities and/or threats and what are the reasons for these perceptions? Second, how do companies use accounting practices in managing their carbon emissions and what, if any, is the linkage between use of accounting practices and climate change perceptions?

Our first question is important because existing literature argues that the *extent* to which companies are aware of the impacts of climate change is an important precursor to action in terms of carbon emission management (Hoffmann, Sprengel, Ziegler, Kolb, & Abegg, 2009; Winn, Kirchgeorg, Griffiths, Linnenluecke, & Gunther, 2011). However, there has been little analysis of *how* companies frame or perceive climate change impacts, or of the possibilities that these perceptions create for stimulating action to manage carbon emissions. Furthermore, accounting research is yet to investigate whether the *type* of perception – as opportunity or threat – influences these actions. This is despite theories of decision-making under conditions of uncertainty, notably prospect theory, suggesting that perceptions of threat rather than opportunity have different consequences for action (Kahneman & Tversky, 1979; 2000).

Our second question is important because accounting practice can be intertwined inextricably with carbon emission management. Setting plans, selecting performance indicators and targets, measuring achievements and incentivising effort are traditional management accounting techniques that arguably will benefit companies' management of carbon emissions (Rietbergen, van Rheede, & Blok, 2015). Indeed, guides for developing organisational action plans to manage carbon emissions emphasise the setting of measurable goals and targets and consideration of incentives (Hoffmann et al., 2009). Yet there has been

little study of how organisations utilise these practices. Overall, much work is required to understand better the role that accounting can and does play in carbon emission management as well as factors that influence its use (Hopwood, 2009).

We seek to contribute by exploring accounting practices used in carbon emission management and how their adoption might be influenced by the framing of climate change impacts. To date, research that examines the relationship between internal and external environmental reporting has tended to be qualitative in nature. Researchers have argued that we need engagement with practice to understand the practice of environmental reporting (Adams & Larrinaga-Gonzalez, 2007; Bebbington, Larrinaga & Moneva, 2008; Lodhia & Jacobs, 2013; Wahyuni & Ratnatunga, 2015). This study provides empirical evidence in respect of this relationship.

UNCERTAINTY, MANAGING CARBON EMISSIONS AND ACCOUNTING PRACTICE

Stern (2007) identifies uncertainty as a central element in most aspects of climate change issues. Not only is there uncertainty about the nature and effects of carbon emissions, there is significant regulatory uncertainty (for example, relating to the politics and detail of pricing carbon). Australia has been particularly prone to political uncertainty surrounding climate change issues (Talberg, Hui, & Loynes, 2013).

Awareness of climate change opportunities and threats is important for overcoming the effects of uncertainty and for stimulating corporate action to manage carbon emissions (Hoffmann et al., 2009; Winn et al., 2011). Recent studies highlight pressures on companies to identify and manage climate change opportunities and threats (Subramaniam et al., 2015). Accounting practices have a productive role to play in activities to manage carbon emissions (Burritt et al., 2011), but little research examines how these practices are involved in plans or actions.

Research shows that companies using accounting practices embed environmental issues into organisational strategies and show improvements in their environmental performance (Perez, Ruiz, & Fenech, 2007; Henri & Journeault, 2010). These studies signal the importance of specific practices involving: (a) planning and target setting, (b) performance measurement, and (c) incentivisation. We explore perceptions of climate change in association with application of these management accounting practices in companies' carbon emission management efforts.

Findings are that the number of accounting practices involved with (a) planning and target setting; (b) performance measurement; and (c) incentivisation is associated with climate change perceptions of net threats (threats less opportunities), but not with carbon intensity sector or control variables. These results provide rare empirical evidence of the relationship between environmentally relevant internal accounting practices and emissions management. As such, we contribute to existing research on corporate climate change responses by providing insights into how managerial perceptions of climate change uncertainties influence the use of management accounting practices in carbon emissions management. An understanding of the above aspect can, in turn, provide managers and policy makers with insights into the mechanisms that stimulate climate change actions by organisations.

Factors that Could Influence Decision Framing

We review prior literature that discusses factors driving companies' environmental actions to develop a set of categories through which to analyse CDP responders' perceptions about climate change (Carbon Disclosure Project (CDP), 2009; Sprengel & Busch, 2011). Arising from this review, we identify four categories of issues, comprising:

1. Compliance: Compliance recognition;
2. Cost: Cost savings/ cost increases/ efficiency;
3. Customer: Customer demand/ customer needs/ new products, services and projects;
4. Reputation: Social responsibility/ social expectancy/ reputation

We use these four categories as the prism through which to measure the identification of threats as well as opportunities arising from regulatory, physical and other uncertainties of climate change.

Prospect Theory and Framing

Prospect theory, which is based on the concept of decision-making under uncertainty, suggests that how decisions are framed and understood leads to different decision outcomes (Kahneman & Tversky, 1979; 2000). If a decision is framed and understood in terms of gains, people tend to avoid risk (risk avoiders), whereas if it is framed as loss, people are more willing to take risk (risk takers). Thus, according to prospect theory, there is an asymmetry in how decision-makers perceive gains and losses of equal amount, with individuals weighting losses more heavily than gains. Although prospect theory focuses on decision-

making at an individual level, researchers have found that it can be applied to study decision-making at the organisational level (e.g. Bromiley, Miller & Rau (2001), Shimizu (2007) and Barberis (2013)).

Prospect theory has been used by researchers in accounting to examine the impact of the framing of bonus contracts on individual performance (Church, Libby, & Zhang, 2008; Hannan, Hoffman, & Moser, 2005) and the influence of performance standards on managers' willingness to pursue risky projects (Chow, Kohlmeyer, & Wu, 2007). Consistent with prospect theory, Widener (2007) found that the extent to which a company faces strategic threats (referred to as 'risk' in her study) influences the importance placed on accounting. Dutton and Jackson (1987) and Jackson and Dutton (1988) studied the link between categorisation of strategic issues and organisational actions. They found that strategic decision-makers are more sensitive to and react more quickly when decisions are framed as "threats" rather than "opportunities". Jackson and Dutton (1988) argued that this "threat-bias" is consistent with the prediction under prospect theory that individuals react quickly to prevent losses compared to realising gains. Moreover, studies which examine Dutton and Jackson's (1987) arguments also find that issues categorised as threats and opportunities have direct influence on executives' decision-making and that strategic decision-makers are threat-biased (Engau & Hoffmann, 2011).

Taking Dutton and Jackson's (1987) assertion that under prospect theory, decision-makers are threat-biased, it can be argued that managers who perceive climate change issues to pose threats rather than opportunities are more likely to engage in carbon emissions management practices and take action to adopt accounting practices for emissions management. Thus, in relation to the research questions (i.e. how companies frame risks associated with climate change and how managerial perceptions of carbon emission issues influence the use of accounting practices in managing carbon emissions), the following hypothesis is posed:

> H1: Companies that frame climate change impact as posing greater rather than lower net threats are more likely to adopt a greater number of management accounting practices comprising: (a) planning and target setting; (b) performance measurement; and (c) incentivisation.

RESEARCH APPROACH

Sample and Data Sources

The sample consists of 69 Australian companies that provided identifiable responses to sections of relevance to this study in the CDP 2009 survey (see Appendix A). The Morningstar FinAnalysis database is used for financial data. Australian companies are considered appropriate for two main reasons. First, Australia has the highest per capita emissions in the developed world (see Garnaut, 2008). Second, Australia is particularly vulnerable to climate change (Stern, 2007). Additionally, at the time of the CDP (2009) survey, there was considerable political uncertainty surrounding climate change policy (see Talberg et al., 2013).

The year 2009 is chosen since it represents the first operative year of Australia's *National Greenhouse Energy Reporting Act 2007*, which required disclosure by high emitters to a government authority of actual carbon dioxide emissions, subsequently made publicly available on a government website. Eligible companies had to register in 2008 and hence incentives for the management of carbon emissions had become much more prominent than previously during this period.

Data Analysis

The main objective of our CDP survey analysis is to gain insight to participants' perceptions of climate change issues as threats, or opportunities, or both. To partition as threats or opportunities, we use a set of four categories developed based on prior literature as set out in "Factor that Could Influence Decision Framing". An 'infrastructure category', focusing on protection of asset infrastructure and business continuity, was added in response to a preliminary review of the CDP (2009) survey data. These five categories (i.e. compliance, cost, customer, reputation, and infrastructure) were used to measure perceived threats and opportunities arising from regulatory, physical and other uncertainties associated with climate change. In relation to use of accounting techniques in managing carbon emissions, we analyse companies' narratives in relation to specific CDP survey questions as is explained later.

Milne and Adler (1999) emphasise how reliability in analysis is enhanced by using well-specified categories and decision-rules, and multiple coders. Decision-rules were developed and pilot tested and a second, independent reviewer coded the entire sample of qualitative responses to questions. Interrater coding agreement exceeded 90%. The next sub-section outlines categorisation protocols and our coding process.

Category Decision-Rules and Variable Construction

Climate Change Perception is assessed using responses to Questions 1 to 6 of the CDP 2009 survey (refer Appendix A). Respondents are asked to consider the threats (referred to as risks) and opportunities arising from: (i) changes in regulation (Questions 1 and 4), (ii) physical climate parameters (Questions 2 and 5), and (iii) other climate change-related issues (Questions 3 and 6). Collectively, these questions request identification of threats and opportunities arising from regulatory, physical and other uncertainties associated with climate change.

For responses to each of Questions 1 to 3, the presence of any of the five categories (compliance, cost, customer, reputation, infrastructure) in discussion of climate change threats is coded '1', and its absence '0'. The same process was repeated for responses to Questions 4 to 6 to examine and code climate change opportunities. When an opportunity or threat was identified, responses to other questions by the same company were examined to tease out the exact nature of the perceived threat or opportunity. Multiple identifications of the same opportunity or threat category in responses to different questions are each counted as separate occurrences. A summary *Climate Change Perception* variable was constructed by subtracting the number of opportunity categories from the number of threat categories identified, creating a difference score. A positive score indicates perception of more threats than opportunities. Table 1 indicates a range for this variable amongst the 69 sample companies of −5 to +7. (Appendix B provides an example calculation).

We examine for patterns between *Climate Change Perception* and use of accounting information. To this end, the quantitative scores generated for each of the constructs of interest are analysed statistically. An assessment of the CDP survey yielded a number of questionnaire items that linked to the management accounting practices of interest. '*Planning and Target-Setting*' was determined from responses to Questions 23.1–23.7, which asked whether the organisation had carbon emission reduction plans and targets and the details of these. '*Performance Measurement'* was measured using responses to Question 23.9 that probed the benchmarks respondents used to assess and monitor progress against carbon emission reduction goals. '*Incentivisation*' was derived from responses to Questions 26.1–26.3, together with comments relating to whether the organisation provided incentives for individual management of climate change issues and specific details of these incentives. Variable descriptives for the management accounting practices are detailed in Table 1.

Table 1
Descriptive statistics

Variable	Observed range	Mean	Standard deviation
Log of size [7.2% <$1bn total assets; 34.8% between $1bn–$5b; 31.9% between $5bn−$10bn; and 26.1% >$10bn]	19 to 27	$22.64bn	1.628
Carbon Intensity Sector [Greenhouse intensive (3) = 31.9%; Climate change exposed (2) = 46.4%; Less exposed (1) = 21.7%]*	1 to 3	2.1	0.731
Climate change perception	−5 to 7	0.667	2.273
Dichotomous variables			
Emissions reduction target setting	0/1	66.7%	
Performance measurement	0/1	55.1%	
Incentivisation	0/1	44.9%	

*These categories are collapsed to Carbon Intensive (CI) (32%) and Low Carbon (LC) (68%) Sectors

Carbon intensity sector, company size, capital intensity, new finance, return on assets, Tobin's Q and new property, plant and equipment are controlled for (Henri & Journeault, 2010). Since systems need to be in place to measure environmental information before it can be disclosed, variables associated with disclosure are expected to be associated with the accounting practices of interest to this study.

Carbon Intensity Sector is coded initially using the three-level sector classification provided in the *CDP Report 2009*. Companies in the Carbon Intensive (CI) sector include utilities, chemicals, construction materials, oil, gas and consumable fuels, metals and mining and transportation. Companies in the 'Other climate change exposed sector' include those exposed to physical risks of climate change (e.g., property), or displaying vulnerability through their customer base (e.g. finance companies and mining contractors). Finally, companies in the "Low Carbon (LC) sector" sector comprise pharmaceutical wholesalers, media providers and telecommunication service providers, coded CI equal to 1, and LC equal to 0. CI companies are expected to use more management accounting practices than LC companies.

RESULTS

Exploring Perceptions of Climate Change Impacts

As reported in Table 2, overall, companies perceive climate change issues as a threat (mean is 0.67). In considering *Climate Change Perceptions* of the two carbon intensity sectors, the LC sector has a mean of 0.36, while for the CI sector it was 1.32. The difference between the two sectors' mean values is significant at the 10% level (*t*-statistic = 1.868).

The rationale for perceiving opportunities or threats attached to the regulatory, physical and other uncertainties of climate change could vary between the LC and CI sectors because climate change issues perceived by managers in the two sectors may not be the same. It is also possible that managers of different companies within the same carbon intensity sector perceive climate change issues differently from one another. For example, as reported earlier in Table 1, the *Climate Change Perception* of the LC sector responders ranged from −5 to 7 with a standard deviation of 2.44. On the other hand, the range for perception in the CI sector was −1 to 5 with a standard deviation of 1.73. From these statistics, it is possible to see differences in perceptions between the two sectors, as well as within a particular sector (as implied by the high standard deviation) but the major focus of this study is on comparison between the two groups.

Table 2 reports how the two sectors' responses identified each issue category arising from climate change issues. There is a significant difference in the way that the two sectors' responses identify compliance issues. The CI sector responses identify a significantly higher (at 5%) mean compliance threat (0.682) than the LC sector (0.234). This finding is not surprising as the CI sector companies are under much higher compliance requirements than the LC sector companies. For the other four issue categories, both sectors have similar responses, with mean differences not significant.

The sub-sections below discuss the narratives companies provided.

Customer threats and opportunities

Customer issues manifested the most often as opportunities or threats when considering regulatory, physical and other uncertainties of climate change, with 218 mentions (Table 2). This profile was weighted towards organisational benefits from climate change, with opportunities comprising 60% of total perceptions from both LC and CI sectors (e.g., being able to fulfil new climate change-related needs, develop new products and work collaboratively with customers

Table 2
Perceptions of Climate Change Impact

Issue category	Low Carbon Sector (LC) N = 48 (70%)			Carbon Intensive Sector (CI) N = 21 (30%)			Full Sample N = 69			*Climate Change Perception* [Total Threats-Total opportunities]/ No. of companies]			*t*- test LC vs CI sectors (*p*-value)
	Total no.	Total Threats	Total Opp.	Total no.	Total Threats	Total Opp.	Total no.	Total Threats	Total Opp.	LC Sector	CI sector	Full Sample	
Compliance	**75** (100%)	43 (57%)	32 (43%)	**37** (100%)	26 (70%)	11 (30%)	**112** (100%)	69 (62%)	43 (38%)	0.234#	0.682	0.377	−2.407 (0.021)
Cost	**138** (100%)	75 (54%)	63 (46%)	**49** (100%)	31 (63%)	18 (37%)	**187** (100%)	106 (57%)	81 (43%)	0.255	0.591	0.362	−1.449 (0.152)
Customer	**155** (100%)	62 (40%)	93 (60%)	**63** (100%)	25 (40%)	38 (60%)	**218** (100%)	87 (40%)	131 (60%)	−0.660	−0.591	−0.638	−0.236 (0.815)
Infrastructure	**62** (100%)	49 (79%)	13 (21%)	**30** (100%)	21 (70%)	9 (20%)	**92** (100%)	70 (76%)	22 (24%)	0.766	0.545	0.696	1.566 (0.125)
Reputation	**61** (100%)	25 (41%)	36 (59%)	**38** (100%)	20 (53%)	18 (47%)	**99** (100%)	45 (45%)	54 (55%)	−0.234	0.091	−0.130	0.923 (0.362)
Mean *Climate Change Perception*										**0.361**	**1.318**	**0.667**	−1.865 (0.067)

#Example calculation: Compliance Low Carbon (LC) Sector (Total Threats-Total Opportunities)/No. of companies = [(43)–(32)]/48 = 0.234

in managing carbon emissions). Thus, revenue and opportunities to deepen relationships were identified, and arose more frequently in relation to regulatory and other climate change uncertainties than to physical uncertainties. For example, Telstra Corporation Ltd, a telecommunication and information service company, identified "customer" opportunities that derived from regulatory uncertainties and flowed to existing products and services as follows:

> Current and anticipated regulatory requirements... creates an opportunity for Telstra as use of our telecommunications products and services (e.g. teleconferencing) can provide practical ways for our customers to use energy more efficiently, and save on carbon emissions

Conversely, a significant number of customer threats were identified, often by the same company representatives who perceived customer opportunities to exist. These were due largely to concerns about the inability to respond in a timely and appropriate manner in accordance with shifting customer expectations in relation to climate change. They arose more frequently in relation to physical and other dimensions of climate change than to regulatory dimensions. Customers reconfiguring their supply chain or reducing their demand for services were the main cause of threats, as the following examples from Telstra, and Amcor, a packaging manufacturer, illustrate:

> Customer demand for our product may decrease in periods where they are affected by weather events.

> Changing expectation of our major customers such as banks or large corporations means that our response to climate change could impact on how we are perceived by our customers. Some customers are already considering greenhouse gas emissions in their supply chain decisions.

However, overall if considering only customer issues, climate change issues were reported by both CI and LC sectors as bringing more opportunities than threats.

Cost threats and opportunities

Cost threats and opportunities were second most frequently identified in relation to climate change uncertainties, with 187 manifestations. This category was considered to represent more negative than positive potential, with threats reported as 54% and 63% of total perceptions by the LC and CI sectors respectively or

57% overall. The cost threat was the largest identified, with 106 total threats. Regulatory and legislative uncertainty was seen as possibly causing cost increases through carbon taxes, compliance costs and increased energy costs. For example, a CI sector company, Boral, a building and construction materials company and heavy user of electricity, commented:

> A third regulatory risk is that of costs imposed by other schemes such as the revamped Australian Mandatory Renewable Energy Target ("RET") scheme. This scheme results in higher electricity prices due to a regulatory target that 20% of electricity supplied must come from renewable generation.

Physical weather-related uncertainty was seen as causing increased insurance and repair and maintenance costs, while other cost increases were considered likely due to resource scarcity. LC sector company, Woolworths, a major retailer, highlighted cost and other threats from resource scarcity:

> Impacts of climate change and drought upon suppliers, including farmers or any food provider, pose a critical risk to Woolworths as it can affect the reliability of supply, cost and quality of products.

Companies also identified opportunities to reduce both costs and emissions by changing internal practices, such as reductions in energy use, travel and fuel consumption, and greater efficiency in resource use. Providing accurate emissions data for regulatory purposes was seen by some as helping to provide insights and impetus to behavioural change towards cost efficiency. LC sector company, United Group, an engineering and property services company, was one such company:

> Regulatory requirements associated with climate change may present opportunities for UGL given the increased rigour that will be required in relation to collecting and collating energy use data. Monitoring and measuring energy use associated with operations may lead to opportunities to reduce energy use and cut energy costs.

In addition, the possibility that customer and supplier behaviours might change as part of climate change action was seen as providing cost reduction opportunities. A change in practices by customers and suppliers to use less carbon intensive products and services and avoid threats associated with climate change was seen as providing opportunities for companies, with QBE Group, one of Australia's larger insurance companies, reflecting this sentiment:

> An increase in customer awareness of potential climate change risks which should positively impact QBE and the insurance industry generally to the extent that increased risk mitigation by the insured could reduce claims costs.

Compliance threats and opportunities

As noted, regulatory impacts had a number of 'indirect effects', but more "direct effects" in terms of compliance were noted, with this being the third most frequently identified issue overall. Reported 62% of the time as threats within the full sample (refer Table 2), compliance issues related almost exclusively to the associated regulatory uncertainties. The CI sector reported much higher threats (70%) than LC sector companies (57%) (refer Table 2). Relating to regulatory threats, potential changes in carbon emissions legislation and regulatory reporting requirements were noted as making it difficult for organisations to make investment decisions, particularly in relation to assets that might have significant carbon emission profiles. Company representatives also noted that it was difficult to understand their regulatory obligations and then fulfil these without experiencing severe economic impacts. For instance, Infigen Energy, a leading independent renewable energy company, noted the following:

> Continual change in regulatory conditions can result in increased uncertainty in the investment environment; unclear, inconsistent or rapidly evolving regulations which make compliance challenging.

High emitters that faced regulatory obligations featured prominently in noting compliance threats. On the other hand, and similar to cost issues, the increased attention to emissions, energy use and measurement of associated activities arising from regulatory requirements, was seen as providing a possibility for overall business benefit. For instance Sigma Pharmaceuticals, a pharmaceutical wholesaler and distribution business, explained that:

> Financial and technical support available ... may result in business/ operational improvements that have financial advantages in excess of higher energy costs.

Thus, it can be seen that compliance issues had some effect on all sample companies either directly or indirectly.

Reputation threats and opportunities

Reputation was the fourth most identified threat-opportunity category in relation to climate change uncertainty, manifesting 54% of the time as opportunities by the whole sample (refer Table 2). However, only the LC sector reported climate change issues bringing more reputational opportunities (59%) than threats (refer Table 2). In considering the CI sector alone, climate change issues were reported as slightly higher threats (53%) than opportunities (refer Table 2). These findings are not surprising as CI sector companies are more prone to negative public perceptions as 'environmental polluters'. In considering the reputational opportunities, being seen as environmental leaders and as proactive companies were some of the commonly cited reasons. For example, LC sector company ANZ Bank explains reputational opportunities as follows:

> Understanding and minimising our environmental footprint is an important part of our responsibility as a large corporation. We face risks to our reputation if we do not meet the environmental standards and practices we encourage our corporate customers and suppliers to adopt.

In other cases, enhanced reputation was reported as providing business and economic benefits. Development of new, environmentally friendly products and enhanced competitive advantage were sometimes identified as reputational benefits. For example, Amcor, a CI sector company and the world's largest packaging company, reported reputational opportunities as follows:

> Amcor Ltd anticipates general opportunities in staying ahead of competitors with regard to climate change preparedness. These opportunities relate to the mitigation of physical, regulatory and other risks as described previously. Amcor Ltd anticipates demand for new or modified packaging options and enhanced reputation.

Conversely, companies also saw reputational threats because of climate change issues. Failure to perform their business activities in accordance with social and environmental norms, and increased exposure to scrutiny of business activities were some of the concerns highlighted as reputational threats.

Infrastructure threats and opportunities

Infrastructure issues were the fifth most identified category of threats and opportunities, but manifested most strongly as having potential for negative

organisational effects, with threats representing 76% of the full sample (refer Table 2). Both sectors see more threats than opportunities; with LC and CI sectors accounting for 79% and 70%, respectively (refer Table 2). These threats were due largely to uncertainty in relation to physical weather parameters and possible increases in the frequency of extreme weather patterns. These possibilities were seen as translating into potentially compromised asset values and reduced infrastructure lifecycles, with on-going capital expenditure implications. Transurban Group highlighted a study it had recently completed in responding to threats from changes in weather parameters associated with climate change:

> Accelerated degradation of materials, structures and foundations of transport infrastructure may occur through increased ground movement and changes in groundwater.

The majority of companies mentioning infrastructure issues raised concerns about their asset mix. However, a minority did report some infrastructure opportunities from climate change. These were mainly in relation to new investment in assets and infrastructure projects suited to a carbon-constrained environment.

In summary, protection of economic interest is the primary concern in relation to climate change issues. Customer and cost opportunities and threats were the most common, with little concern for reputation or corporate social responsibility unless associated with economic benefits. This absence of discussion about ethical or moral obligations may be due to the role of institutional investors as the main CDP audience (Solomon et al., 2011), creating an investor driven and 'market governance' system (Rankin, Windsor, & Wahyuni, 2011).

Accounting Practice Use in Carbon Emission Management

Table 3 reports results for accounting practices overall and for LC and CI companies. Frequencies are: (i) Planning and target-setting (67% overall, 62% for LC, 77% for CI); (ii) Performance measurement (55% overall, 57% for LC, 50% for CI); and (iii) Incentivisation (45% overall, 47% for LC and 41% for CI). None of these mean differences is significant.

The next four sub-sections discuss the use of the four accounting practices and the disclosed reasons for use.

Table 3
Use of accounting practices in emission management

Accounting practices	Carbon Intensity Sector				Full Sample N = 69		*t*-test (*p*-value)
	Low Carbon Sector (LC) N = 47		Carbon Intensive Sector (CI) N = 22				
	Yes	No	Yes	No	Yes	No	
Planning and target setting	29 (62%)	18 (38%)	17 (77%)	5 (23%)	46 (67%)	23 (33%)	−1.275 (0.207)
Performance measurement	27 (57%)	20 (43%)	11 (50%)	11 (50%)	38 (55%)	31 (45%)	0.572 (0.569)
Incentivisation	22 (47%)	25 (53%)	9 (41%)	13 (59%)	31 (45%)	38 (55%)	0.453 (0.652)

Planning and target setting

Planning and Target Setting, comprising the development of emission reduction plans and targets, was the most widely used accounting practice (67%). However, one-third of companies failed to establish targets for emission reduction purposes. As explained in the CDP 2009 report, planning and target setting provide evidence of companies' commitment to reducing their carbon emissions and the actions they intend to take in mitigating any emissions liabilities. The lack of emissions reduction targets among these companies could be a concern to their investors as "*…it may indicate that emissions reduction actions are not being strategically planned*" (CDP, 2009, p.12).

The motives for companies that had implemented emissions reduction targets included improvement of internal impetus and fulfilment of external regulatory requirements. The main internal drivers for companies to engage in target setting included shaping actions relating to emissions reduction, improving operational efficiency, minimisation of waste, and communication of levels of performance to be achieved. For example, Telstra explained how it used planning and target setting as tools in driving its environmental commitment and improving environmental performance as follows:

> Setting measurable targets demonstrates that we are serious about providing good stewardship of the environment – and what gets measured gets done. We believe that adopting a target will help motivate our company to Identify novel solutions to reduce Telstra's carbon intensity.

Measurement was cited as the key barrier to targets, illustrated by Computershare's response:

> ...we recognise that more needs to be done, particularly in the area of measurement and targets. We have therefore begun the task of measuring our operational impact to date, to create a baseline against which we can establish the implementation of environmental objectives...

Performance measurement

The use of performance measurement, usually using non-financial measures, as part of monitoring progress was claimed by 55% of companies. For example, Commonwealth Bank of Australia provided the following:

> The Bank will track progress towards our reduction target of 20% CO_2-e by 1 July 2013 by using two key performance indicators: CO_2-e emissions per FTE and CO_2-e emissions per net lettable area of commercial and retail space occupied by the Bank in Australia.

A few companies reported energy savings as well as cost savings, including Coca-Cola Amatil:

> In our plants, CCA looks to innovate through energy saving projects. At 2008, 24 energy saving projects identified with the Australian EEO [energy Efficiency Opportunity] scheme had been implemented. This has saved more than 22,000GJ energy or 6,111 megawatt hours/4,500 TCO2-e, equating to annual net benefits of approximately $160,000.

Of companies without performance measurement, approximately one-third claimed to be considering or developing measurement approaches to support assessment of carbon emission management initiatives. The remainder failed to provide any explanation for their lack of use.

Incentivisation

The use of incentives was amongst the least frequently used accounting practice (45%). Amongst those companies using incentives to manage carbon emissions, variation existed with respect to the specificity of incentives offered. Only a third of companies indicated explicitly that they provided incentives that rewarded

specific carbon emission reduction behaviours and achievements. Westpac Bank was one such company, focusing specifically on incentives for carbon emission reduction to motivate efforts and hold people accountable where considered appropriate:

> Emissions reduction targets are included in personal scorecards of a number of individuals across the organisation and directly impact on their bonus potential. Our Executive Team (i.e. our CEO and their direct reports) have a shared emissions reductions target and where appropriate to job role these have been cascaded to General Manager Level and below.

In contrast, half providing incentives used general incentives aimed at driving overall corporate social responsibility actions.

Of the 38 (55%) companies that did not report incentives, 28 did not provide any explanation. These companies represent not only large companies but are also members of industries such as energy, resources, construction, mining and manufacturing, which have a significant emission exposure. Of the remainder, one company indicated an absence of incentives due to a relatively small carbon footprint, while the others argued existing incentive schemes influenced climate change action indirectly, with the following response from Origin Energy illustrative of this approach:

> Executive management does not have specific incentives for managing climate change issues. However, a significant part of the remuneration of senior management consists of equity and equity-based instruments whose value is dictated by the long-term performance of the company. The long-term performance of the company is influenced to a very large extent by the company's ability to foresee and to deliver within the regulatory environment, of which climate change regulation forms a great part, and the social and economic environment, which is also affected by climate change issues

CONCLUSION, LIMITATIONS AND FUTURE RESEARCH

The findings revealed that first, companies, in general, perceived carbon emission issues as a risk when attempting to achieve organisational objectives. Customer, cost, and compliance issues were identified as the most influential factors that manifested most threats and opportunities associated with climate change issues.

It was seen also that companies' identification of climate change threats and opportunities was driven primarily by the motive of protecting their financial interests.

Second, low use of accounting practices in managing climate change issues was uncovered, perhaps a consequence of the lack of involvement of accounting professionals in emission management activities. Arguably, accounting professionals could have a substantial role in driving implementation of practices such as appropriate planning, measurement and incentivisation schemes in managing emissions.

Third, consistent with prospect theory arguments, a significant positive association was found between perceptions of threats or opportunities and the accounting practices. As argued by Sebora and Cornwall (1995), if prospect theory explains strategic decision makers' behaviours under conditions of uncertainty, creating greater awareness of framing effects could achieve positive outcomes.

Finally, regulatory requirements seem to have a significant influence on companies' responses. In particular, not only the cost enforced by a carbon tax, but also the uncertainty associated with climate change appears influential. While such 'direct effects' were noted, with compliance issues a number of 'indirect effects' were also observed. Regulatory changes and uncertainties had material effects in relation to company identification of both customer and cost opportunities and threats. However, as evident from this study, uncertainty around climate change regulations hinders long-term actions, such as investments in emission management.

Limitations include the relatively small sample size, use of self-reported information and the potential for changes in perceptions of threats and opportunities since 2009. Nevertheless, institutional investors have been instrumental in CDP's success in eliciting climate change information from respondents (Kolk, Levy, & Pinkse, 2008) and are likely to have their own perspectives on climate change implications facing individual organisations, especially since they can interrogate firm management through forums such as private meetings (see Solomon et al., 2011). This suggests a level of correspondence between disclosed CDP information and actual perceptions and accounting practices. Future research could examine more recent CDP data, and compare companies' annual responses over time with their actual emissions performance, where this is available.

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APPENDIX A

Relevant Questions from the CDP (2009) survey

Climate Change Perceptions

1.1. Is your company exposed to regulatory risks related to climate change?

2.1. Is your company exposed to physical risks from climate change?

3.1. Is your company exposed to other risks as a result of climate change?

4.1. Do regulatory requirements on climate change present opportunities for your company?

5.1. Do physical changes resulting from climate change present opportunities for your company?

6.1. Does climate change present other opportunities for your company?

Use of Planning and Target Setting

23.1. Does your company have a GHG emissions and/or energy reduction plan in place?

23.2. Please explain why.

23.3. Do you have an emissions and/or energy reduction target(s)?

23.4 What is the baseline year for the target(s)?

23.5. What is the emissions and/or energy reduction target(s)?

23.6. What are the sources or activities to which the target(s) applies?

23.7. Over what period/timescale does the target(s) extend?

Use of Performance Measurement

23.9. What benchmarks or key performance indicators do you use to assess progress against the emissions/energy reduction goals you have set?

Use of Incentivisation

26.1. Do you provide incentives for individual management of climate change issues including attainment of GHG targets?

26.2. Are those incentives linked to monetary rewards?

26.3. Who is entitled to benefit from those incentives?

APPENDIX B

Analysis of CDP (2009) survey responses

Participating companies are requested to identify risks (threats)/opportunities driven by:

1. Changes in **regulations** (Questions 1 and 4).
2. Changes in **physica**l climate parameters (Questions 2 and 5).
3. Changes in **other** climate-related developments (Questions 3 and 6).

The following two aspects were taken into consideration:

(a) Multiple identifications of the same opportunity or threat category in responses to each question were counted as separate occurrences.

(b) If respondents mentioned the same issue more than once under Question 1, it was counted as "1".

Example *Climate Change Perception* Analysis for AGL Group Ltd

						Total
	Regulatory Risk (CDP Q.1)					
	Compliance	Cost	Customer	Infrastructure	Reputation	
AGL	1	1	1	0	0	3
	Physical Risk (CDPQ. 2)					
	Compliance	Cost	Customer	Infrastructure	Reputation	
AGL	0	1	1	1	0	3
	Other Risk (CDP Q. 3)					
	Compliance	Cost	Customer	Infrastructure	Reputation	
AGL	0	0	1	0	1	2
			Total Risk			**8**
	Regulatory Opportunities(CDP Q. 4)					
	Compliance	Cost	Customer	Infrastructure	Reputation	
AGL	1	1	1	1	0	4
	Physical Opportunities (CDP Q. 5)					
	Compliance	Cost	Customer	Infrastructure	Reputation	
AGL	0	0	0	0	0	0
	Other Opportunities (CDP Q. 6)					
	Compliance	Cost	Customer	Infrastructure	Reputation	
AGL	0	1	1	0	0	2
			Total Opportunities			**6**
Climate Change Perception (Total Threats [Risk]−Total Opportunities)= (8−6)						**2**