Climate Change Risks/Opportunities and Regulatory Intervention as Possible Determinants of Sustainability Reputation: An Exploratory Study

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Abstract:

Climate change has continued to dominate both the political and business agenda for many years now. Utilising the institutional governance framework, this research aims to explore whether regulatory intervention and the firm's anticipation of climate change risks and opportunities are related to sustainability reputation as evidenced by the firm's inclusion in the "Global 100 Most Sustainable Corporations in the World" (G100) list from 2005 to 2010. Recognising the wide visibility and strong economic impact of large corporations, the world's largest 500 companies (Top500) is the focus in this study. To facilitate an exploratory analysis, seventy-six G100 companies that are included in the Top500 are identified and matched one-to-one with other Top500 companies offering similar products/services, bringing the total sample to 152 firms. Climate change data are taken from the Carbon Disclosure Project (CDP). The logistic regression analyses confirm that the firm's anticipation of climate change opportunities is positively and significantly related with proactive firm's (G100) sustainability reputation, while the firm's recognition of climate change regulatory risks show significant and negative association implying that higher state intervention discourage reactive firms (non-G100) from neglecting climate change issues. The result also shows that the G100 companies have significantly better medium-term profitability compared to their non-G100 counterparts.

Keywords: *World's Largest Companies, Sustainability Reputation, Climate Change Risks/Opportunities*

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1. Introduction

Whilst the 'green' business literature advocates that there is no alternative to sustainable development[1], climate change has generally been ignored in the corporate world as recently as two decades ago (Kolk, Levy & Pinkse, 2008). As mounting evidence from the scientific community points to anthropogenic greenhouse gasses (commonly called carbon)[2] as the main cause of climate change, the past decade saw carbon management dominating both the political and business agenda. As such, an increasing number of companies are beginning to take a more constructive stance by anticipating the risks as well as the opportunities brought about by climate change (Margolick & Russell, 2004).

The initial motivation for this study has emerged from the idea that corporate initiatives to anticipate climate change risks and opportunities are essential to the formulation of strategies addressing the environmental impact of the firm which could then improve the firm's reputation and overall performance. It must be noted that this overall performance should encompass the three dimensions of sustainability commonly known as the ***3P's***: planet (environmental), people (social) and profit (economic). Although the notion that recognition of climate change risks and opportunities may be related to overall performance and sustainability reputation has not been directly examined yet, prior studies have attested to this, albeit indirectly. For example, Cogan (2006) suggests that companies moving ahead on climate change are being rewarded by financial markets while those lagging behind are considered more risky.

Similarly, studies investigating the link between sustainability/corporate social performance (CSP) and corporate financial performance (CFP) have been well documented. Margolis and Walsh (2001) report that about 50% of the studies reviewed found positive relationship between CSP and CFP. Orlitzky, Schmidt and Rynes (2003), in their meta-analysis of corporate social and financial performance literature spanning more than 25 years, find that there is generally a positive association between CSP and CFP and this occurred mostly across industries and in a wide variety of study contexts. An analysis of 70 studies examining the relationship between environmental governance and financial performance commissioned by the Environment Agency in England and Wales (White & Kieman, 2004) reveals that positive relationship existed in 85% of the studies assessed. In addition, Sullivan (2009) finds that most European large companies now have systems and processes in place to manage carbon emissions and related business risks but uncertainties in climate change policy act as the key barrier for companies to take a more proactive approach.

In relation to this latter statement pertaining to regulatory uncertainties acting as hindrance for firms to be more proactive, a further motivation for this study is to explore whether government legislations could, in fact, trigger a more proactive response to climate change.

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[1] The term 'sustainable development' is defined by the United Nations (cited in Langfield-Smith *et al* 2009, p. 851) as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs".

[2] Anthropogenic greenhouse gasses pertain to gas emitted as a result of human activities. According to the Kyoto Protocol, an international agreement the sets binding obligations on industrialised nations to reduce GHG emissions (established by the United Nations Framework Convention of Climate Change), there are six GHGs that needs to the monitored namely: carbon dioxide, methane, nitrous oxide, perfluorocarbon, hydrofluorocarbon and sulphur hexafluoride.

In view of this, the purpose of this research is to explore whether regulatory intervention and the firm's anticipation of climate change risks and opportunities are related to sustainability reputation as evidenced by the firm's inclusion in the list of "Global 100 Most Sustainable Corporations in the World" (G100). Recognising the wide visibility and strong economic impact of large corporations, the world's largest 500 companies (Top500) is chosen as the focus for this study. To facilitate an exploratory analysis, seventy-six G100 companies that are included in the Top500 are identified and matched one-to-one with other companies in the Top500 offering similar products/services bringing the total sample to 152 firms. Climate change data are taken from the Carbon Disclosure Project (CDP).

The logistic regression analyses confirm that the firm's anticipation of climate change opportunities is significantly related with the firm's superior sustainability reputation (i.e. positive association), while the firm's recognition of climate change regulatory risks is also significant (i.e. negative association) implying that higher state intervention discourage even the reactive (non-G100) firms from neglecting climate change issues. The result also shows that firms with superior sustainability reputation (G100) have significantly better medium-term profitability compared to their non-G100 counterparts.

The rest of the paper will proceed as follows. The next section outlines an overview of the relevant theory adopted in this study leading to hypotheses development. Research methods are provided next followed by the discussion of results. Finally, the summary and concluding comments are offered together with the limitations of this study.

2. Theory and hypotheses development

2.1 Sustainability & Institutional Governance Systems

Sustainability has become a 'buzz' word since the turn of the 21st century but few really know what it means or whether it is indeed achievable. Transposing the most common definition of the term 'sustainable development' (see footnote 1) to the business level, Dyllick and Hockerts (2002, p. 131-132) propose that:

> … 'Corporate sustainability' can be defined as "meeting the needs of a firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities, etc.), without compromising its ability to meet the needs of future stakeholders as well. Towards this goal, firms have to maintain and grow their economic, social and environmental capital base while actively contributing to sustainability in the political domain.

From this definition, it is imperative that business entities have to excel in all three sustainability dimensions (i.e. the ***3P's***: ***planet*** -environmental, ***people***-social and ***profit***-economic) in order to remain competitive and sustainable in the long-run. This is quite contrary to the traditional classical and neoclassical views[3] which suggest that business and society are in a symbolic 'tug of war' where environmental/social responsibility and economic performance are seen to be competing.

In relation to this, the social responsibility literature (e.g. Carroll, 1979; Hunt & Auster 1990; Henriques & Sadorsky 1999; Buysse & Verbeke, 2003) suggests that corporate social responsiveness can range on a continuum from a 'wait-and-see' (reactive) position to becoming 'ahead-of the-pact (proactive) stance'. This reactive/proactive position has been used to assess corporate sustainability commitment level (see e.g. Elijido-Ten, 2013) where a distinction is made between firms that adopt an 'outside-in' *vs* 'inside-

[3] The classical view promotes that the firm's sole responsibility is to maximise profits (Friedman, 1970) while the neo classical view extends this notion by suggesting that while the business' primary function is to create wealth, this function must be tempered by its obligations to society (see Freeman, 1984). Tempering with societal obligations such as pollution control, responsible carbon sequestration, employee and product safety, just to name a few, inevitably increase costs thereby reducing profitability.

out' approach. Companies whose sustainability measures/disclosures are driven by external regulations are adopting the outside-in approach while those that develop sustainability measures ahead of regulations utilise the inside-out approach (Langfield-Smith et al, 2009). Bebbington, Larrinaga and Moneva (2008) believe that there is an element of 'reputation risk management' involved in the firm's decision to act proactively and provide disclosures over and above what is legally required. Numerous contemporary management thinkers suggest that taking a proactive stance by focussing on environmentally sustainable economic activity is the catalyst to innovation and competitiveness (see Hart, 1995; Porter & van der Linde, 1995; Nidumolu, Prahalad & Rangaswami, 2009; Porter & Kramer, 2011) which lead to enhanced corporate performance/reputation.

Institutional theory, being premised on the principle that organisations adopt structures in response to institutional pressures (DiMaggio & Powell, 1983), has been used in prior studies to make sense of the apparent conflict between society, on one hand, and business entities on the other. Education and legislation (Porter & Kramer, 2011), which can shape public/market opinion (Meyer & Rowan, 1977), are the two most common methods used to induce companies to take their social and environmental responsibility seriously. While both methods provide a source of corporate pressure, each favours a different level of government involvement. High level of state intervention is necessary to enact mandatory legislations while public education can be achieved with much lower level of state involvement.

Some suggest that educating the general public through media coverage about the companies' social responsibilities would force businesses to put sustainability at the top of their priority list (Elijido-Ten, 2011a). Others argue that corporate voluntary actions are not likely to be sufficient in our quest to save the planet and its inhabitants, hence the need for tougher regulations (Alexander, 2007). Still others claim that even a combination of this two-pronged solution (education and legislation) will not be a panacea as long as society and businesses are seen to be at odds with each other (Porter & Kramer, 2011).

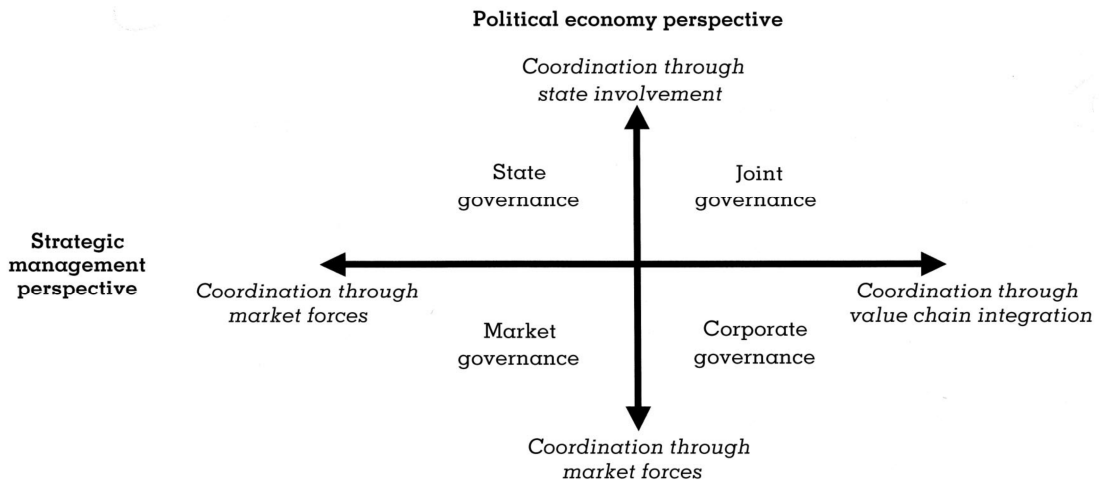
In this regard, the institutional governance systems framework (see Griffiths & Zammuto, 2005; Griffiths, Haigh & Rassias, 2007) can offer a useful theoretical 'lens' by which we can understand the interplay behind the reactive/proactive position on climate change employed by large international corporations as a determinant of corporate sustainability performance and reputation. In addition, it allows the incorporation of different levels of government involvement, either through legislation or education, as a source of pressure to induce climate change related corporate actions.

The institutional governance framework draws upon two main streams of research, the strategic management and political economy literature, each presenting an inherently different way of explaining the firm's source of competitive advantage (Murtha & Lenway, 1994; Biggart & Guillen, 1999). The ***strategic management perspective*** is described as 'firm-centric' given that firm performance is driven by its own resources, strategies and industry structure while the ***political economy perspective*** is referred to as 'state-centric' given its claims that government involvement, through legislations, drives the competitive capabilities of firms (Griffith & Zammuto, 2005). Thus, each perspective promotes different levels of state involvement. While the strategic management literature supports voluntary corporate actions regarding climate change with minimal state intervention (e.g. Porter, 1980, 1985, 1990; Chandler, 1990; McGahan & Porter, 1997; O'Sullivan, 2000; Hoffman, 2005), the political economy research tradition advocates that government regulatory intervention is crucial to achieve competitive outcomes such as climate change mitigation and adaptation particularly in a dynamic environment (see, e.g. Weiss & Hobson, 1995; Dobbin & Dowd, 1997; Weiss, 1998). In introducing a framework to understand the Australian climate change governance systems, Griffiths *et al* (2007) posit that these two seemingly competing views can be taken as complimentary explanations to explore how decisions are made and how these are shaped by governance systems designed to reduce carbon emissions. Institutional governance system is, therefore, defined as:

"…the configuration of state and private organizations [sic] and institutional arrangement that impact on and create the mechanisms by which economic and social outcomes within nations are produced" (Griffiths *et al,* 2007, p. 416).

Thus, the institutional governance framework incorporates two dimensions broadly underpinning the coordination of economic and decision making themes (Griffiths & Zammuto, 2005; Griffiths *et al,* 2007). As shown in Figure 1, the strategic management dimension entails value chain integration on one side and market forces on the other. The political economy dimension necessitates the coordination of decision making and economic activities through state involvement on one end and by market forces on the other. The ensuing quadrants from this typology introduce four institutional governance systems which are used by Griffiths *et al* (2007) to characterise patterns of industry engagement with climate change activities. These are briefly described below.

Figure 1: Four Institutional Governance Systems



Source: Griffiths and Zammuto, 2005)

State governance, being state-centric, is where the government plays a major role in negotiating and structuring outcomes through state led regulations and targets. Under this system, value chains may be fragmented since the state does not necessarily intervene with value chain activities leaving this aspect to market forces and managerial decisions. This is similar to the 'outside-in' approach mentioned earlier. ***Joint governance*** pertains to industrial transformations where state is involved in value chain integration and decision making to encourage broader product and process innovations and opportunities (Amsden, 2001; Mathews, 2002). ***Market governance*** is characterised by a low level of government intervention. Here, decision making and economic activities are driven by market forces with minimal value chain integration. Climate change actions are seen as a cost or risk rather than an opportunity. Thus, this system focusses on protecting access to resources (Griffiths & Zammuto, 2005). Finally, due to government reluctance to intervene, under ***corporate governance***, it is expected that state involvement is very little but value chains are heavily integrated as a result of greater "inside-out' managerial push to link supply, production and distribution to create competitive advantage (Griffiths, 1998). Consequently, emphasis on climate change issues is subject to self-monitoring systems where proactive firms looking for opportunities to integrate value chain in their carbon reduction initiatives are likely to excel.

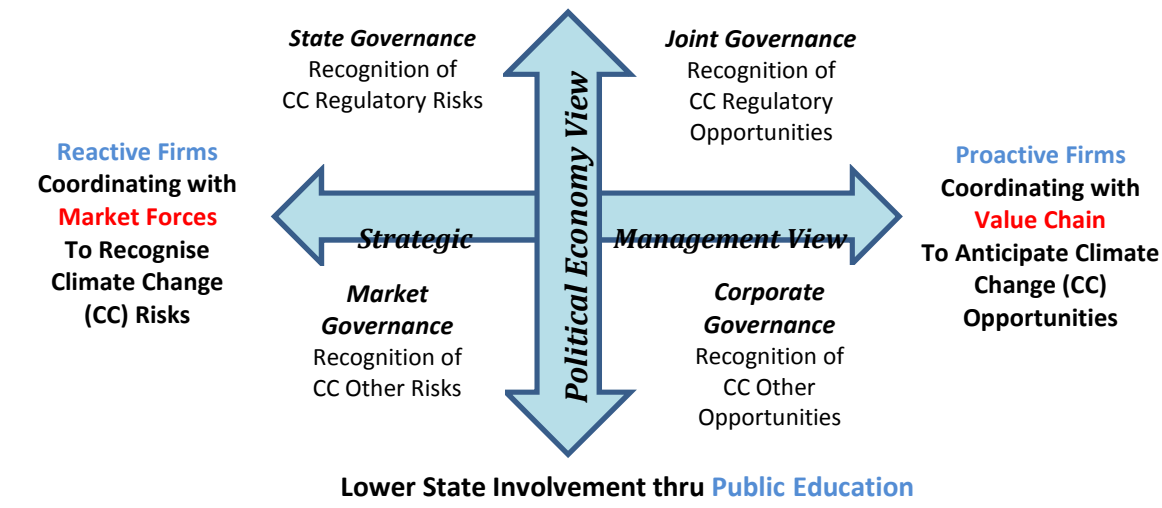
2.2 Proposed Framework and Hypotheses Development

Despite the intuitive appeal of the aforementioned institutional governance systems framework to analyse corporate climate change approach, it is proposed that the insights offered from the social responsiveness literature, i.e. the *reactive/proactive* position of firms can provide additional insights to the strategic management view. Furthermore, the incorporation of the institutional pressure arising from *regulatory legislations* and the less stringent *public education* to drive public opinion regarding climate change issues will allow meaningful analysis.

As shown in Figure 2, the political economy view entails, on one end, that high level of government intervention through mandatory legislations is needed to achieve superior performance while on the other end, a low level of state involvement, possibly through public education, is proposed to promote the ideals of free enterprise. The strategic management view, being firm-centric, could incorporate the distinction between, on one end, the ***reactive firms*** which would tend to coordinate with *market forces* in coping with climate change risks, and on the other end, the ***proactive firms*** which are likely to lead and anticipate climate change opportunities through innovative use of the value chain.

Figure 2: Theoretical Framework:

Incorporating Institutional Pressures and Corporate Social Responsiveness



Thus consistent with the purpose of this research to explore the relationships between regulatory intervention and corporate anticipation of climate change risks and opportunities as possible determinants of corporate sustainability performance and reputation, the above framework provides a useful conceptual lens from which the following hypotheses are tested.

H1: Higher state intervention through regulatory legislations is more likely to induce better corporate climate change response.

H2: Proactive firms anticipating climate change opportunities are more likely to have superior sustainability reputation.

The logic underpinning **H1** is drawn from the political economy view suggesting that state involvement even with value chain integration and decision making could potentially open more opportunities for broader product/process innovations resulting in better corporate sustainability performance. Furthermore, this can add weight to calls for tougher regulations on climate change (e.g. Alexander, 2007).

On the other hand, **H2** flows from the strategic management view. Thus, it is expected that companies having superior sustainability reputation are the ones more willing to go beyond simply reacting to risks and to utilise not only its own resources and capabilities but also its value chain to anticipate opportunities brought about by climate change.

3. Research Design

3.1 Data Collection and Sampling Method

Recognising the wide visibility of large corporations, the target population for this study is the world's largest 500 companies (Top500) as of 2010. Using *sales turnover* and *publicly listed active company* as the two main search criteria, respectively, the Top500 data are retrieved from MintGlobal database. Operated by Bureau van Dijk, MintGlobal provides a wide variety of information from companies around the world. Financial performance data are also sourced from this database.

The matched sampling method is done in two stages. In the first stage, all the companies that make the "Global 100 Most Sustainable Corporations in the World" (G100) list from 2005 to 2010 are collated. This is done to identify the G100 firms that are large enough to be in the Top500. Since 2005, the *Corporate Knights*, a Toronto-based media and investment research company, has conducted an annual initiative to recognise the top 100 most sustainable corporations that have been most proactive in managing environmental, social and governance issues. This initiative provides an external review of the top 10% most sustainable global corporations from a universe of 3,000 developed and emerging market stocks (see http://www.global100.org/). Thus, the companies in the G100 list are deemed to have the best developed capabilities, relative to their industry peers, to manage environmental, social and governance risks, and to take advantage of new opportunities in these areas.

There are 89 companies from the Top500 that made it to the G100 list from 2005 to 2010. Given the different operational nature of companies in the insurance, banking and financial industries, they are excluded from the sample bringing the total number of G100 firms to 76 companies. In the second stage, the nature of products/services offered by these 76 firms are analysed and matched one-to-one with other non-G100 firms in the Top500 that offer similar products/services. Hence, the final sample consists of 152 companies.

The CORE database provided by the Carbon Disclosure Project (CDP) is used as the main data source to examine the sample firm's acknowledgement of climate change risks and opportunities. CDP is a non-profit organisation claiming to hold the largest database of primary corporate climate change information in the world (CDP Website). Since 2003, CDP has surveyed companies asking them to voluntarily provide information about the business implications of climate change. The number of companies responding to this annual survey has grown more than tenfold from around 230+ in 2003 to more than 3,000 companies in 2010. This rapid increase in voluntary participation among companies worldwide seems to suggest that perceptions of climate change impact have also increased dramatically. It is in this regard that the use of CDP data on corporate climate change perceptions from voluntary CDP participation is justified.

3.2 Variable Measurement and Justification

3.2.1 Dependent Variable - Sustainability Reputation

Based on the argument that sustainability is an ongoing process that does not happen immediately, all firms that made it to the G100 list from 2005 to 2010, either once or perennially, are included in the initial sample. The G100 key performance indicators (KPIs) include such things as carbon, energy, safety, water and waste productivity as well as transparency, innovation capacity and leadership diversity, among others. Using the G100 companies as a proxy for sustainability performance/reputation arguably overcomes the heavy bias towards either the social or the environmental aspect of firm performance (Walsh, 2010). Moreover, a sustainability ranking provided by an external body is seen as an independent measure which lessens the problem of self-promotion among firms.

The identified G100 companies are then matched with an equal number of firms from the Top500 that offers similar products/services. The dependent variable, *sustainability reputation* (SR), is a dichotomous variable coded '1' for G100 firms while their matched non-G100 industry peers are coded '0'.

3.2.2 Explanatory Variables - Climate Change Risks and Opportunities

In view of the fact that the key to managing the impact of climate change is to recognise its risks and to anticipate the opportunities arising from regulatory and market pressure, CDP's survey data provides a good secondary data source. The 2010 CDP survey asks participating firms to answer, among others, the following questions:

Q1: Do current and/or anticipated *regulatory requirements* related to climate change present significant *risks* to your company?
Q2: Do current and/or anticipated *regulatory requirements* related to climate change present significant *opportunities* to your company?
Q3: Does climate change present *other significant risks* – current and/or anticipated – for your company?
Q4: Do current and/or anticipated physical impacts of climate change present *other significant opportunities* for your company?

Although the above questions simply require a 'Yes' or 'No' answer, firms who answered Yes to these questions are asked to provide further information including, but not limited to, the nature of risks/opportunities, what actions have been done/about to be done, how it may affect the value chain and its financial implications. A perusal of the narrative explanations provided by firms who responded 'Yes', particularly to Q2 & Q4 (i.e. anticipating opportunities), confirms that these firms are more proactive in addressing climate change issues. In addition, companies who answered 'Yes' to Q1 and Q2 (pertaining to regulatory risks and opportunities) are likely to have been induced more by higher level of state intervention to recognise and anticipate climate change implications.

Thus, four dichotomous explanatory variables are chosen to test Hypothesis 1 (**H1**) namely, *climate change regulatory risks* (CCRegRsk), *climate change regulatory opportunities* (CCRegOpp), *climate change other risks* (CCOthRsk), and *climate change other opportunities* (CCOthOpp). Firms that voluntarily participate in the 2010 CDP survey that answered 'Yes' to the above questions are coded 1. All other companies included in the sample that did not answer 'Yes' or did not participate in the CDP survey are coded 0. To test Hypothesis 2 (**H2**), two explanatory variables are included, *climate change risks* (CCRisk) and *climate change opportunities* (CCOpps). Companies that answered 'Yes' to recognising both regulatory and other risks/opportunities are coded 2; firms who answered 'Yes' to either regulatory or other risks/opportunities are coded 1 while the remainder are coded 0.

3.2.3. Control Variables

Financial Performance: ROA. Since sustainability performance and reputation is likely to have been based on past initiatives, the accounting based measure of financial performance is chosen because it has the advantage of being free from market perceptions concerning the firm's future earnings ability. Prior studies use various measures for financial performance but the most commonly used accounting measure of profitability is the return on assets (e.g. Roberts, 1992; Gonzales-Benito & Gonzales-Benito, 2005; Walsh, 2010; Elijido-Ten 2011b). Given that in this exploratory study, the focus is on overall performance (i.e. the 3Ps including profit), it is expected that G100 firms have better medium-term profitability than their non-G100 counterparts. The lagged (2005-2009) five-year average return on assets is used as the proxy for the financial performance.

Size: LRev. Although, as noted earlier, the target population for this study is the world's largest 500 firms, it is quite possible that there could still be big differences between, e.g. fifty largest companies compared to the rest. As such, we control for size by using the natural log of the firm's five-year average revenues (2005-2009) consistent with prior research (e.g. Roberts, 1992; Hoque & James, 2000).

Voluntary External Disclosure: CDP. Given that there are some companies included in the sample that did not answer or voluntarily provide climate change related disclosure from the CDP data, *CDP* is also used as a control variable. Hence, a value of 1 is awarded to firms disclosing through CDP in 2010, 0 otherwise.

3.3 Logistic Regression Model

The regression model used to test Hypotheses 1 and 2, respectively, are as follows:

$$SR_i = \beta_1 CCRegRsk_i + \beta_2 CCRegOpp_i + \beta_3 CCOthRsk_i\ \beta_4 CCOthOpp_i\ \beta_5 ROA_i + \beta_5 LRev_i + \beta_6 CDP_i + e$$

$$SR_i = \beta_1 CCRisk_i + \beta_2 CCOpp_i + \beta_3 ROA_i + \beta_4 LRev_i + \beta_5 CDP_i + e$$

Where:

SR_i = 1 for firms in the Top 500 Largest Company in the World (Top500) that has been included in the Global 100 Most Sustainable Corporation (G100) between 2005 to 2010; 0 otherwise, for firm *i;*

$CCRegRsk_i$ = 1 for firms disclosing through Carbon Disclosure Project (CDP) in 2010 that answered YES to the question whether they perceive regulatory risks arising from climate change (CC); 0 otherwise for firm *i*;

$CCRegOpp_i$ = 1 for firms disclosing through CDP in 2010 that answered YES to the question whether they anticipate CC regulatory opportunities; 0 otherwise for firm *i*;

$CCOthRsk_i$ = 1 for firms disclosing through CDP in 2010 that answered YES to the question whether they recognise other significant CC risks; 0 otherwise for firm *i*;

$CCOthOpp_i$ = 1 for firms disclosing through CDP in 2010 that answered YES to the question whether they anticipate other significant CC opportunities; 0 otherwise for firm *i*;

$CCRisk_i$ = 2 for firms disclosing through CDP in 2010 that answered YES to recognising both regulatory and other CC risks; 1 for firms who answered YES to either regulatory or other CC risks; 0 otherwise for firm *i*;

$CCOpps_i$ = 2 for firms disclosing through CDP in 2010 that answered YES to anticipating both regulatory and other CC opportunities; 1 for firms who answered YES to either regulatory or other CC opportunities; 0 otherwise for firm *i*;

ROA_i = Return on Assets: 5-year Average for firm *i*;

$LRev_i$ = Natural log of five-year average revenues for firm *i;*

CDP_i = 1 for firms disclosing thru Carbon Disclosure Project (CDP) in 2010; 0 otherwise for firm *i;*

e = error term

H1 will be supported if the regulatory risks and opportunities (CCRegRsk & CCRegOpp) are associated with sustainability reputation. On the other hand, to find support for **H2,** it is expected that anticipation of climate change opportunities (CCOpps) is prevalent for G100 companies given their superior sustainability reputation.

4. Results and Discussion

4.1 Descriptive Statistics

Table 1 shows the descriptive statistics for the dichotomous/indicator variables (in Panel A) and the continuous variables (in Panel B). There are equal numbers of G100 and non-G100 companies because of the one-to-one matching process employed. As shown in Panel A, a total of 105 firms (69.1%) anticipated climate change regulatory opportunities (CCRegOpp). This is 10% higher than the number of companies that recognised climate change regulatory risks (CCRegRsk), i.e. a total of 90 firms or 59.2% of sample firms. The number of firms that recognised other climate change risks and opportunities are a lot less, i.e. only half (76 firms) recognise other risks and even less (73 firms) anticipated other opportunities arising from climate change. Panel A also shows that nearly half (74 out of 152 or 48.7%) of the sampled firms recognised both regulatory and other climate change risks (CCRisk). About the same number of companies (73 firms) anticipated both regulatory and other climate change opportunities. Finally, nearly 80% (122 firms) had voluntarily participated in the CDP survey.

Panel B shows that the mean five-year average return on assets (ROA) among the selected Top500 firms in the sample is 7.66. This is quite a conservative mean ROA considering that the sampled firms are among the world's 500 largest companies. A closer look at the minimum of -10.43 and the maximum of 25.86 (with a standard deviation of 6.12) reveals a wide dispersion of profitability among sampled firms. The natural log of revenues range from a minimum of 7.04 to a maximum of 8.59 with mean and standard deviation of 7.52 and 0.31, respectively.

INSERT TABLE 1 ABOUT HERE

4.2 Bivariate Correlations

Table 2 contains the non-parametric Spearman's rho correlation matrix. Panel A shows the bivariate correlations for all the H1 variables while Panel B contains the H2 variables. All the explanatory variables, that is, the CCRegRsk, CCRegOpp, CCOthRsk, CCOthOpp, CCRisk and CCOpps are correlated to the dependent variable, SR. Indeed, with the exception of CCRegRsk which is correlated to SR at $p<.05$, all the independent variables have a significance level of $p <0.0001$ indicating strong correlation. Among the control variables, only the proxy for size (LRev) is found to be insignificant. Both ROA and CDP are highly significant at $p<0.0001$.

INSERT TABLE 2 ABOUT HERE

There is no indication that an unacceptable level of multicollinearity is present because none of the correlation coefficient between predictor variables is higher than 0.80. Statistics experts (see for example, Hair et al., 1998; Tabachnik & Fidell 2001) suggest that a harmful level of multicollinearity is not present until the correlation coefficient reaches around 0.80 or 0.90.

4.3 Logistic Regression Results

Table 3 shows the results of the logistic regression analyses conducted. Panel A contains the regression results for Hypothesis 1 (**H1**) while Panel B presents the results for Hypothesis 2 (**H2**). As shown in Panel A, the empirical model is significant at less than 0.0001 level with model chi-square score statistic of 44.398 and 7 degrees of freedom. The Cox & Snell R^2, Nagelkerke R^2 and McFadden R^2 are .442, .59 and .421, respectively, indicating that the model explains between 42% to 59% of the variability in the dependent variable. The empirical model in Panel B is also significant at less than 0.0001 level with model chi-square score statistic of 39.225 and 5 degrees of freedom. The Pseudo R^2 indicates that the model explains between 37% to about 54% of the variability in the dependent variable.

INSERT TABLE 3 ABOUT HERE

In terms of the prediction emanating from the political economy view (**H1**), i.e. the association between sustainability reputation and state intervention, the result shows that both CCRegRsk ($p<.10$) and CCRegOpp ($p<0.05$) are significant suggesting that regulatory intervention drives companies to incorporate climate change in their decision making. The positive sign for the B value of CCRegOpp implies that regulatory pressure may have encouraged G100 firms to achieve superior sustainability reputation while the negative sign for CCRegRsk seems to suggest that their non-G100 counterparts have been discouraged to ignore the risks brought about by climate change. Moreover, both CCOthRsk and CCOthOpp are not significant confirming further that the anticipation of other climate change risks and opportunities that are not driven by regulations are minimal. In view of this, **H1** is supported.

Turning to the prediction from the strategic management view (**H2**), the result in Panel B shows that CCOpp has a positive sign and is significant at less than 0.10 implying that anticipation of opportunities arising from climate change is associated with superior sustainability reputation. The odds ratio (Exp(B)) for CCOpp suggests that the odds of a Top500 firm being included in the G100 list is about 1.8 times higher for companies that anticipate climate change opportunities. In contrast, CCRisk is not significant. This could be taken to suggest that recognition of climate change risks is not sufficient to create competitive edge needed to boost corporate sustainability performance and reputation. Therefore, **H2** is also supported.

The results also show, under both models, that the proxy for financial performance, ROA, has a positive B value that is highly significant ($p<0.01$). In contrast to Gonzales-Benito and Gonzales-Benito's (2005) study of 186 industrial companies finding no evidence that environmental proactivity translates to short-term profitability, this result provides a strong indication that sustainability and medium-term profitability can go hand in hand. As expected, size is not significant since all firms in the sample are in the Top500 largest firms in the world. Finally, although the bivariate correlations show that CDP participation (CDP) and SR are significantly associated, when the other variables are included in the model, CDP is no longer significant. This is not overly surprising given that the target population in this study is the world's largest corporations. As such, it is reasonable to expect that the pressure to provide climate change information voluntarily, given their public visibility, would be similar regardless of whether they are in the G100 list or not.

5. Summary and Concluding Comments

In an attempt to explore whether regulatory intervention and anticipation of climate change risks and opportunities are related to corporate sustainability reputation, this study adapted the institutional governance framework to gain insights from the predictions emanating from both the political economy and

strategic management perspectives. This study focussed on the world's largest 500 corporations (Top500) because of their wide visibility and economic impact. Data were sourced from *Corporate Knight's* "Global 100 Most Sustainable Corporations in the World" (G100), Carbon Disclosure Project's (CDP) corporate survey responses and MintGlobal database. In conducting this study, the G100 companies that are included in the Top500 are identified and matched with the other Top500 companies that offer similar products/services.

Two hypotheses were tested. **H1** emanating from the political economy view suggests that higher state involvement through regulatory legislations could induce better corporate climate change response. On the other hand, **H2** flowing from the strategic management view predicts that proactively anticipating climate change opportunities (as opposed to simply reacting to climate change risks) is likely to enhance corporate sustainability reputation.

The logistic regression results provide support for both **H1** and **H2**. Indeed, the analysis confirms that the firm's anticipation of climate change opportunities is significantly related to the firm's superior sustainability reputation (i.e. positive association), while the firm's recognition of climate change regulatory risks is also significant (i.e. negative association) implying that higher state intervention discourage even the reactive (non-G100) firms from neglecting climate change issues. Moreover, the result also shows that the G100 companies have significantly better medium-term profitability compared to their non-G100 counterparts.

The results from this exploratory research are of interest given the insights they provide. Reflecting back to the institutional governance framework, one can reasonably conclude from these results that the optimum governance system would be one of ***joint governance*** where the government, through regulatory intervention, and proactive firms (i.e. those who are anticipating climate change opportunities) work together to improve overall performance and progressively achieve 'sustainable development'. As expected, the result confirms that ***state governance*** is essential particularly when reactive companies are prevalent as these firms are forced to recognise the risks posed by climate change. Since the anticipation of other climate change risks and opportunities which are not driven by regulations are minimal, it would seem that the institutional governance systems characterised by ***market governance*** and ***corporate governance*** are not the most effective systems to obtain positive climate change corporate response.

Moreover, drawing from the positive and significant association between sustainability reputation and profitability (i.e. ROA), it can be concluded that sustainability and profitability are not necessarily mutually exclusive. This result affirms that *creating shared value* (Porter & Kramer, 2011) between business and society is not just a 'nice concept'. Indeed, moving beyond the sustainability and profitability trade-off is economically viable.

The findings from this study, however, are subject to a number of limitations. As in most quantitative studies, data constraints may limit the construct validity of some variables. However, considerable efforts have been made to choose appropriate proxies after consulting the relevant literature. Likewise, it is important to acknowledge the inherent limitations of positivistic empirical research to capture the complexity of numerous dimensions included in this analysis. Furthermore, due to the fact that the empirical tests are performed on the Top500 largest companies in the world, its generalisability to small or medium-size companies could be limited. Despite these constraints, the insights gathered from this exploratory research can be useful as a springboard for more in-depth studies. In particular, sustainability practices and innovations introduced by specific companies in response to anticipated climate change opportunities can be used as case studies to provide exemplary practical examples.

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Table 1: Descriptive Statistics

Panel A: Dichotomous/Indicator Variables

Variables	Variable Description	Number of Firms with 2	(%)	Number of Firms with 1	(%)	Number of Firms with 0	(%)
SR	1 for firms in the Top 500 Largest Company in the World that has been included in the Global 100 Most Sustainable Corporation (G100) between 2005 to 2010; 0 otherwise			76	50.00%	76	50.00%
CCReg Rsk	1 for firms disclosing thru Carbon Disclosure Project (CDP) in 2010 that answered YES to the question whether they recognise regulatory risks arising from climate change (CC); 0 otherwise			90	59.20%	62	40.80%
CCReg Opp	1 for firms disclosing thru CDP in 2010 that answered YES to the question whether they anticipate regulatory opportunities arising from CC; 0 otherwise			105	69.10%	47	30.90%
CCOth Rsk	1 for firms disclosing thru CDP in 2010 that answered YES to the question whether they recognise significant other risks arising from CC; 0 otherwise			76	50.00%	76	50.00%
CCOth Opp	1 for firms disclosing thru CDP in 2010 that answered YES to the question whether they anticipate significant other opportunities arising from CC; 0 otherwise			73	48.00%	79	52.00%
CDP	1 for firms disclosing thru CDP in 2010; 0 otherwise;			122	80.30%	30	19.70%
CCRisk	2 for firms disclosing thru CDP in 2010 that answered YES to recognising both regulatory and other CC risks; 1 for firms who answered YES to either regulatory or other CC risks; 0 otherwise;	74	48.70%	18	11.80%	60	39.50%
CCOpps	2 for firms disclosing thru CDP in 2010 that answered YES to recognising both regulatory and other CC opportunities; 1 for firms who answered YES to either regulatory or other CC opportunities; 0 otherwise;	73	48.00%	32	21.10%	47	30.90%

Panel B: Continuous Variables

Variable	Variable Description	Minimum	Maximum	Mean	Standard Deviation
ROA	**Return on Assets: 5-year Average**	-10.43	25.86	7.66	6.12
LRev	**Natural log of 5-year Average Revenue**	7.04	8.59	7.52	0.31

Table 2: Correlations

Panel A: Bivariate Correlations for H1 Variables

	SR	CCReg Rsk	CCReg Opp	CCOth Rsk	CCOth Opp	ROA	LRev	CDP
SR - Sustainability Reputation	1.000							
CCRegRsk - Climate Change Regulatory Risk	0.187*	1.000						
CCRegOpp - Climate Change Regulatory Opportunities	0.327**	0.719**	1.000					
CCOthRsk - Climate Change Other Risk	0.263**	0.776**	0.584**	1.000				
CCOthOpp - Climate Change Other Opportunities	0.329**	0.476**	0.643**	0.540**	1.000			
ROA - Return on Assets	0.316**	.047	.042	.067	.082	1.000		
LRev - Natural Log of Revenues	.089	.094	0.164*	.123	.105	-.008	1.000	
CDP- Carbon Disclosure Project	0.298**	0.597**	0.741**	0.496**	0.477**	.109	.128	1.000

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

Panel B: Bivariate Correlations for H2 Variables

	SR	**CCRisk**	**CCOpps**	**ROA**	**LRev**	**CDP**
SR - Sustainability Reputation	1.000					
CCRisk - Climate Change Risks	0.240**	1.000				
CCOpps - Climate Change Opportunities	0.361**	0.659**	1.000			
ROA - Return on Assets	0.316**	.063	.072	1.000		
LRev - Natural Log of Revenues	.089	.115	.142	-.008	1.000	
CDP- Carbon Disclosure Project	0.298**	0.574**	0.643**	.109	.128	1.000

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

Table 3: Logistic Regression Model and Results

Panel A: H1 Logistic Regression Model & Results (N=152)

$$SR^*_i = \beta_1 CCRegRsk_i + \beta_2 CCRegOpp_i + \beta_3 CCOthRsk_i\ \beta_4 CCOthOpp_i\ \beta_5 ROA_i + \beta_5 LRev_i + \beta_6 CDP_i + e$$

**SR stands for Sustainability Reputation; explanatory & control variables are as shown in the table below.*

Explanatory Variables	B	Std. Error	Wald	df	Sig.	Exp(B)
CCRegRsk - Climate Change Regulatory Risk	-1.405	.799	3.092	1	.079	.245
CCRegOpp - Climate Change Regulatory Opportunities	2.192	1.057	4.298	1	.038	8.955
CCOthRsk - Climate Change Other Risk	.997	.752	1.757	1	.185	2.711
CCOthOpp - Climate Change Other Opportunities	-.192	.556	.120	1	.729	.825
Control Variables						
ROA - Return on Assets	.210	.058	12.949	1	.000	1.234
LRev - Natural Log of Revenues	2.735	1.689	2.623	1	.105	15.416
CDP- Carbon Disclosure Project	.019	1.013	.000	1	.985	1.019

Model Chi-square = 44.398 with 7df significant at less than 0.0001 level

Pseudo R^2: Cox & Snell = .442; Nagelkerke = .590; McFadden .421

Panel B: H2 Logistic Regression Results (N=152)

$$SR^*_i = \beta_1 CCRisk_i + \beta_2 CCOpp_i + \beta_3 ROA_i + \beta_4 LRev_i + \beta_5 CDP_i + e$$

**SR stands for Sustainability Reputation; explanatory & control variables are as shown in the table below.*

Explanatory Variables	B	Std. Error	Wald	df	Sig.	Exp(B)
CCRsk - Climate Change Risks	-0.132	0.34	0.151	1	0.698	0.876
CCOpp - Climate Change Opportunities	0.581	0.338	2.944	1	0.086	1.787
Control Variables						
ROA- Return on Assets	0.187	0.052	12.932	1	0.000	1.206
LRev- Natural Log Revenue	2.178	1.566	1.935	1	0.164	8.832
CDP - Carbon Disclosure Project	0.711	0.831	0.733	1	0.392	2.036

Model Chi-square = 39.225 with 5 df significant at less than 0.0001 level

Pseudo R^2: Cox & Snell = .403; Nagelkerke = .538; McFadden .372