The Extent and Determinants of Greenhouse Gas Reporting in the United Kingdom

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ABSTRACT

The study investigates the extent and determinants of greenhouse gas voluntary disclosures by FTSE350 United Kingdom (UK) listed companies from both theory and practitioners' views. In accomplishing the aim, the study has the following objectives: (1) to analyse the extent of voluntary disclosure of GHG information in annual and sustainability reports of FTSE350 companies over a four year period i.e. 2008-2011; (2) to establish whether voluntary GHG disclosures are influenced by corporate governance characteristics (board size, non-executive directors, environmental committee, audit committee, ownership concentration and director ownership) and firm characteristics (company size, profitability, gearing, liquidity and industry); and (3) To investigate whether practitioners consider the determinants (as in objective two above) motivates the extent of voluntary GHG disclosures.

To accomplish the objectives, the study uses a mixed-method approach on data derived from a sample of 215 FTSE 350 companies listed on London Stock Exchange. Firstly, an econometric model was developed based on a set of explanatory factors i.e. the governance and company characteristics and a dependent variable of disclosure index drawn from a multiple GHG voluntary reporting frameworks. Panel regression was then employed to examine the relationship between the explanatory factors and the actual disclosures. Secondly, through survey questionnaire, company executives were asked to rate their perception of the extent to which a list of determinants derived from largely secondary data literature influenced voluntary GHG disclosure.

The results indicate an increasing trend in GHG disclosures from 2008 to 2011 perhaps suggesting positive impact of the government initiatives on GHG disclosures in the UK. Overall there is more disclosure of qualitative information in particular information on company action on GHG and climate change rather than actual emission disclosures. Companies have also not been proactive in disclosing quantified estimates of all forms of risks emanating from climate change. Results of the econometric model show that there is no support for the influence of traditional board characteristics such as Non-executive Directors, board size, and audit committee whereas both forms of ownership had a significant negative influence. The presence of an environmental committee was only significant in enhancing qualitative information and not quantitative information. In addition, as in other voluntary disclosures, size plays a vital role in determining the extent of the disclosures and that highly geared companies disclose less GHG information than less geared firms. Liquidity and profitability have no significant influence.

The survey results suggest that according to the practitioners, board environmental committee and firm size are the only determining factors to have received wide support by the respondents while all other factors were firmly rejected. The findings that other determinants do not influence disclosure of GHG from a practitioner point of view suggests the need for an in-depth investigation into the determinants of voluntary disclosures beyond the evidence as derived from secondary data based studies.

The study contributes knowledge to the voluntary disclosure studies in a number of ways. First, through mixed data approach, it has brought additional insights into the determinants of GHG disclosures. For example, through the primary survey data approach, evidence is documented that confirm and also contradict the secondary data approach findings in respect of both some governance and company variables. This suggests the need for more research using the mixed-method approach in an attempt to reveal why the results contradict. Secondly the results enrich voluntary disclosure literature by bringing disclosure determinants evidence through longitudinal data. Insights obtained from both the data triangulation and longitudinal study setting will help inform existing debate on policy options with regard to GHG emission disclosure. Finally the study contributes to the GHG disclosure literature by developing a comprehensive GHG voluntary disclosure index drawn from a various reporting guidelines. Such a comprehensive index will help ensure that adequacy of company GHG disclosures is assessed based on robust instrument.

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To the entire Chithambo clan, I say, I have pushed the family's dream to this far and the mantle is left for the next generation to set a new bar.

DECLARATION

This thesis is submitted in fulfilment of the requirements for the degree of Doctor of Philosophy (Accounting and Finance) at the Bournemouth University, United Kingdom. I declare that this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that this thesis has not been previously or concurrently submitted, either in whole or in part, for any other qualification at the Bournemouth University or other institutions.

Lyton W. Chithambo
December 2013

DEDICATION

I dedicate this thesis to the memory of my father who dearly wanted to do a PhD but life was too short for him to realise his dream and to my deceased mother who did everything possible in her power that I should triumph over poverty through education but never lived long to enjoy the fruit of her labour.

LIST OF ABBREVIATIONS AND ACRONYMS

AIMR	Association for Investment and Research
AP	Agreement Participants
CCAs	Climate Change Agreements
CCA	Climate Change Act
CCC	Climate Change Committee
CCL	Climate Change Levy
CDSB	Climate Disclosure Standards Board
CEO	Chief Executive Officer
CDM	Clean Development Mechanism
CDP	Carbon Disclosure Project
CDTS	Carbon Disclosure Transparency Score
CED	Corporate Environmental Disclosure
CFOs	Chief Financial Officers
CGHGD	Corporate Greenhouse Gas Disclosures
CRS EES	Carbon Reduction Commitment Energy efficiency Scheme
CSR	Corporate Social Responsibility
CSEAR	Centre for Social and Environmental Research
DEFRA	Department for Environment Food and Rural Affairs
DOWN	Director Ownership
DP	Direct participants
EEC	Energy Efficiency Commitment
ERUs	Emissions Reductions Units
EU ETS	European Union Emission Trading Scheme
FASB	Financial Accounting Standards Board
FTSE	Financial Times and Stock Exchange
GDP	Gross Domestic Product
GFCRD	Global Framework for Climate Risk Disclosure
GHG	Greenhouse Gas
GRI	Global Reporting Initiative
GWP	Global Warming Potential
HCFCs	Hydrochlorofluocarbons

JI	Joint Implementation
ICB	Industry Classification Benchmark
IAS	International Accounting Standard
IASB	International Accounting Standards Board
IFRIC	International Financial Reporting Interpretations Committee
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organisation for Standardisation
NAO	National Audit Office
NAPs	National Allocations Plans
NED-ratio	Non-Executive Director Ratio
NGOs	Non-Governmental Organisations
NFFO	Non Fossil Fuel Obligations
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
OWCON	Ownership Concentration
PAS	Publicly Available Standard
PFCs	Perfluorocarbons
PwC	Pricewaterhouse Coopers
ROA	Return on Assets
ROE	Return on Equity
SED	Social and Environmental Disclosures
SER	Social and Environmental Reporting
SRO	Scottish Renewable Obligation
TBL	Triple Bottom Line
UKCCP	United Kingdom Climate Change Programme
UK	United Kingdom
USA	United States of America
USAID	United States Agency for International Development

CHAPTER ONE

Introduction and Overview of Research

1.0 Introduction

This research investigates the extent and determinants of Greenhouse Gas (GHG) emissions voluntary reporting in annual and sustainability reports of FTSE350 companies in United Kingdom for the period 2008 to 2011. Decades of scientific research and related criticism has seen climate change, global warming and GHG emissions becoming key phrases that both politicians and business captains find hard to ignore or indeed ignore at their own peril (Stern, 2007; Porter and Reinhardt, 2007; Kolk and Pinkse, 2004). In political circles, scepticism has now given way to sensible debates as to what needs to be done to decisively deal with or reverse the trend of global warming (Wegener *et al.,* 2013). In this respect, regional bodies such as the EU and countries including United Kingdom (UK), Canada, Australia and recently USA have been developing strategies as part of their response to global warming (Warren, 2007; Stern, 2007; Wegener *et al.,* 2013). In the same vein, pressure has been and is being exerted on businesses to demonstrate their green credentials (Hoffman, 2005; Lash and Wellington, 2007; Lee *et al.,* 2013).

Particularly, in response to this emerging threat, the UK government introduced a set of initiatives known as the Climate Change Programme (Wordsworth and Grubb, 2001). In part, these initiatives led to the enactment of the Climate Change Act (CCA) 2008. Among other things, the CCA recognises that measuring and reporting GHGs is critical to the fight against global emissions, with section 83 requiring the government to issue guidance on this. Therefore, the government through Department of Energy, Food and Rural Agriculture (DEFRA) issued guidance on GHG emissions measurement and reporting in 2009. DEFRA (2009), which is voluntary, aims at supporting UK firms in reducing their contribution to climate change. Modelled on the GHG Protocol (2004), the guidance outlines the measurement and reporting criteria for GHGs (DEFRA, 2009), and is aligned with other voluntary GHG-reporting frameworks, such as International Organization for Standardization (ISO) 14064-1, a specific standard that details accounting and reporting for GHGs.

Under this guidance i.e. DEFRA (2009), firms calculate emissions from activities they control (both direct and indirect carbon footprints), then categorise them into three 'scopes' (with measurement determined by multiplying activity data by emission factors provided by the authorities), and finally disclose total emissions (expressed in CO_2e tonnes) and the

measurement criteria/standard used. The organisation then carries out a strategic analysis of its carbon emissions, and discloses actions taken to reduce them and corporate-governance processes introduced to manage them, including the opportunities available (e.g. emissions trading schemes). Finally, the guidelines call for disclosure of carbon-related risks – both physical (e.g. the impact of climate change on company operations) and regulatory (e.g. the potential effect of carbon regulation on company operations).

Therefore although other GHG reporting guidance (e.g. GHG Protocol, 2004; Global Framework for Climate Risk Disclosure; Carbon Disclosure Project; Carbon Disclosure Standard Board; Global Reporting Initiative; ISO 14064-1) already existed, the publication of the government-backed 2009 guidance brought momentum and policy clarity to UK companies. However, it should be highlighted that reporting is just one of the many policy instruments relied upon by the UK government in its bid to meet both international and own commitments to attain a carbon constrained future. Through the CCA the UK has legally binding target of achieving at least an 80% cut in GHG emissions by 2050 and a reduction of at least 34% by 2020 against a 1990 baseline.

Nonetheless, despite realisation that the battle against climate change cannot be won without genuine and decisive action and accountability by companies who are considered to be the main culprits (Solomon and Lewis, 2002), the policy move by most governments and the UK in particular, can at best be described as 'cautious' preferring firms to do things voluntarily than issuing mandatory regulations. Thus since launching its climate change program at the beginning of the 21st Century, the UK has shied away from issuing outright regulation mandating GHG emission reporting until recently through the Companies Act 2006 (Strategic and Directors' Reports) Regulations 2013 when such has been made mandatory for FTSE350 companies with effect from September 2013. In the circumstances and in the broader context of environmental management, firms have been implementing their environmental and climate change strategies and have been communicating the same through various mediums like annual reports, sustainability reports and websites. However considering the voluntary nature of prevailing regimes coupled with the uncertainty surrounding the cost and benefits of engaging in such voluntary initiatives, questions still remain as to the extent and what within a firm determines the extent of these voluntary GHG disclosures and indeed, what role do existing decision making structures such as board mechanisms play in the disclosure decisions (Galbreath, 2010; Peters and Romi, 2012; Rodrigue *et al.,* 2013).

There is now a general interest among academic researchers to investigate the determinants of voluntary climate change and GHG emissions disclosures and literature in this area is steadily growing. The majority of the studies have examined specific firm characteristics (i.e. size, industry, profitability and leverage) and other general contextual factors like country of origin, or firms belonging to a country which is a signatory of Kyoto Protocol (Freedman and Jaggi, 2005; Prado-Lorenzo et al 2009; Stanny and Ely, 2008; Stanny 2011; Berthelot and Robert, 2011). Few studies notably Prado-Lorenzo and Sanchez (2010), Galbreath (2010) and Peters and Romi (2012) have extended their investigation to review the role of governance factors like board size, board committees, non-executive directors and ownership structure.

Nonetheless, in either setting, the results are often conflicting. For instance, while the majority of GHG disclosure studies (Rankin et al., 2011; Prado-Lorenzo et al., 2009; and Freedman and Jaggi, 2005) concluded that gearing had an insignificant role in GHG voluntary disclosures, Luo and Tang (2011) found that gearing was significantly influenced firms to be transparent in carbon disclosure. Similarly, Freedman and Jaggi (2005); Prado-Lorenzo et al. (2009); Rankin et al. (2011); Cotter and Najar (2011) have found profitability to be insignificantly related to GHG disclosures whereas Berthelot and Robert (2012) found it to be positively related to GHG disclosures. On governance variables, there is a general absence of evidence testing the impact of other known governance characteristics like board size, non-executive directors and ownership characteristics. Of the few undertaken, conflict of results is evident. Berthelot and Robert (2012), Peters and Romi (2011) found evidence that presence of an environmental committee positively influences GHG disclosures while Rankin et al (2011) did not find any significant relationship.

Whilst there may be many reasons for the contradiction in results, the variations in sample, research design and proxies used to represent different theoretical viewpoints investigated in the studies have been suggested as possible causes in quantitative studies on determinants of disclosure (Wallace et al., 1995). The mixed results have led to calls for the use of other research approaches like qualitative approach or use of primary data in addition to the predominantly quantitative approach in form of ordinary least squares (OLS) regression to improve our understanding of the determinants of extent of disclosure. For example, Beattie and Smith (2012) noted that primary research based disclosure studies are rare and yet such research approach can bring enormous benefits to the understanding of the motives for disclosure. In particular primary data based studies suggest investigating the

determinants of voluntary disclosure using the quantitative approach is inadequate because there are other internal contextual factors that may affect disclosure (Adams 2002; Gray *et al.*, 2001). Consequently, there have been calls for academic research to begin investigating the influence of the specific governance structures on voluntary disclosure using the qualitative approach and or employ primary data (Adams 2002; Michelon and Parbonetti, 2012).

1.1 Research Questions

In achieving the aim of the research, three research questions will be answered namely; To what extent did FTSE350 companies disclose GHG information between 2008 and 2011?; Is the extent of voluntary GHG disclosures influenced by corporate governance characteristics (board size, non-executive directors, managerial ownership, and ownership concentration) and firm characteristics (company size, profitability, and leverage) and which of the determinants of voluntary disclosures as derived from secondary data evidence, in the opinion of the Finance Directors, determines the extent of voluntary GHG disclosures?

1.2 Research Objectives

Therefore in an attempt to answer the set research questions and the calls for more studies on GHG voluntary disclosures, this research is to investigate the extent and determinants for voluntary GHG disclosures by companies operating in the UK from both a theoretical (secondary) and practical (primary) viewpoint. The target sample is FTSE350 companies over a four year period i.e. 2008-2011 and the focus will be on the following objectives:

I) To analyse the extent of voluntary disclosure of GHG information in annual reports, sustainability reports and websites of FTSE350 companies over a four year period i.e. 2008-2011;

II) To establish whether voluntary GHG disclosures are influenced by corporate governance characteristics (board size, non-executive directors, managerial ownership, ownership concentration) and company characteristics (company size, profitability, and leverage); and

III) To investigate whether practitioners consider the determinants (as in objective two above) motivates the extent of voluntary GHG disclosures.

Thus, though there is burgeoning research focussing on climate change and GHG emissions reporting, there is still a sense that other aspects like determinants and motivation for engaging in these actions remains unexplored (Okereke, 2007; Milne and Grubnic 2011). Besides, though it might appear a natural thing to simply extend the motivation and determinants as understood from environmental disclosures to GHG emissions disclosures as is the case in most studies conducted to date, climate change and GHG emissions needs to be handled differently. Thus the importance of establishing the extent and determinants for GHG or climate change disclosures is reinforced by the nature of climate change itself. Though businesses may strategise to deal with Climate change in the broader context of environmental issues, yet climate change is different in that, *'its impact is global, the problem is long-term, and the harm is essentially irreversible'* (Lash and Wellington, 2007, p.3). In addition, as noted by O'Dwyer et al. (2005) firms are between a rock and a hard place in as far as GHG emissions disclosures are concerned since active environmental and other NGOs having mobilised institutional investors to force firms to disclose, they can use the very same disclosed information to pressure a firm to change its practices. However neglecting the issue is not an option either since that may expose them to potential reputational risk and legal liability (Kolk *et al.,* 2008). Thirdly, as discussed above, the contradiction in results reported so far means there is still much to be understood in the GHG voluntary disclosures.

1.3 Importance of UK Context in the Study

By studying the extent and determinants of GHG voluntary in UK based companies in the period between 2008 and 2011 when the government had stepped up its policy instruments and rhetoric towards climate change, the study also addresses a long standing issue as to the efficacy of voluntary guidance as opposed to mandatory guidance. By investigating extent of disclosure over a four year period including one i.e. 2009 when DEFRA guidance was issued, the study partly assesses whether firms have responded positively to the 2009 guidance by disclosing significantly more GHGs information, and if so whether voluntary (as opposed to mandatory) reporting regimes can adequately enable policy makers to influence a desired outcome. Proponents of regulation argue that without this, organisations lack incentives to voluntarily disclose adequate information; opponents, meanwhile, assert that it is only through market forces that optimal disclosure levels are achieved (Gore, 2004). The regulatory regime governing information disclosure in the UK has followed the tradition of the English law that only principles are laid down and the rest is supplemented by managerial discretion (Arnold and Matthews, 2002). However, the 2009 guidance is an exception, giving

a detailed account (and even illustrations) of how companies should measure and disclose GHGs. The research will also assess whether this achieved the desired outcome.

1.4 Research Method

To accomplish the objectives, the study uses a mixed-method approach on data derived from a sample of FTSE 350 companies listed on London Stock Exchange. Firstly, an econometric model was developed based on a set of explanatory factors i.e. the governance and company characteristics listed and a dependent variable of disclosure index drawn from a multiple GHG voluntary reporting frameworks. Panel regression is then employed to examine the relationship between the explanatory factors and the actual disclosures. Secondly, through a survey questionnaire, Company executives are asked to rate their perception of the extent to which a list of explanatory factors derived from largely secondary data literature influences their level of disclosure. The FTSE 350 was chosen because it is broad enough to cover a wide range of industries and it comprises big companies that may set the pace on GHG reporting. Brammer and Pavellin (2006) suggest that the use of large companies in a diverse range of industries permits a comprehensive review of disclosure and reasonable generalisability of results. The period 2008 to 2011 was chosen because it covers two years before and after the publication of DEFRA's 2009 guidance. The total number of firms in the sample after excluding financial firms and other companies with no information was 215. Financial firms were excluded on the basis that they are subjected to various prudential regulations which may materially affect the nature of their capital governance structures and that could affect the outcome of this study.

For the survey, questionnaires were sent to finance directors of the 215 companies and after follow-ups only 69 responded of which 62 were usable. The analysis was in large part based on descriptive statistics. In addition, apart from ranking based on mean, based on prior literature (Graham *et al.*, 2005; Nauman and Giel, 1995), a modified top two box and bottom two box scores were used to explore the pattern of the responses. Using this approach, the original five point scale in the surveys was collapsed to increase the clarity of the data for reporting purposes. Scales were collapsed into "bottom two box" and "top two box" scores. Bottom two box scores represented the percentage of respondents who selected responses that were considered negative i.e. disagree or strongly disagree, taken from the bottom portion of the five point scale. The top two scores represent the percentage of respondents who selected responses that were considered positive i.e. agree or strongly agree. The middle column

which referred to neutrality formed its own group. Thereafter the summarized results were subjected to a *t*-test between the mean score of each item and its neutral score.

1.5 Summary of Results

The results indicate an increasing trend in GHG disclosures from 2008 to 2011 but a particularly significant increase is evident between 2009 and 2010. The results also suggest that governance mechanisms (director ownership and ownership concentration) and company specific control variables (size, gearing and industry) have a significant effect on GHGs disclosure. However, there is no support for the effect of other corporate governance mechanism (board size, audit committee, environmental committee and non-executive directors) and company specific control variables (profitability and liquidity).

To the contrary, results using the primary data indicate that with the exception of environmental committee, none of the corporate governance variables is a significant determinant of GHGs disclosure. In fact, company specific variable (size) is the only significant determinant of GHGs disclosure that is confirmed by both secondary and primary data approaches. However when the survey responses are compared to the regression outcome of the respondents firms for 2011, the two research methods are consistent in that they both suggest that corporate governance characteristics (board size and proportion of non-executive directors) do not determine the extent of GHG disclosures. On the other hand, the two research approaches yielded different results for the other two corporate governance variables (ownership concentration and directors' share ownership). While a negative and significant influence of both ownership structures through secondary data is found, a strong rejection is recorded by the survey respondents.

The results have implications on both disclosure literature in general and GHG voluntary disclosure in particular. The contradiction of results from both secondary and primary data approach suggest the need to extend the understanding of disclosure determinants through various means other than just through secondary data. The fact that GHG disclosure extent could not be explained through traditional board structures may suggest that the sample has homogenous board structures and hence there is need to extend investigation into the role of governance beyond those structures stipulated as minimum requirements in governance code. In this respect studies may focus on particular characteristics of environmental committees or specific departments/personnel responsibility for environment and climate change.

1.6 Contribution of Research

The study contributes knowledge to the voluntary disclosure studies in a number of ways. First, through mixed data method approach, it has brought additional insights into the determinants of GHG disclosures. For example, through the primary data approach, evidence is documented that confirm and also contradict the quantitative secondary data approach findings in respect of both some governance and company variables. This suggests the need for more research using the mixed-method approach in an attempt to reveal why the results contradict. In recent times, studies have tended to narrow their focus to GHGs disclosures and hence literature in this respect is growing (See Prado-Lorenzo et al., 2009; Freedman and Jaggi 2005; Rankin et al., 2011; Stanny, 2011). But just like prior studies focussing on social and environmental studies, these studies have heavily relied on testing secondary data against a disclosure index with the aim of analysing determinants of these disclosures. None have attempted to investigate whether the determinants as derived by secondary data are indeed perceived as such in practice.

One advantage of primary data is that it is able to obtain specific responses to a specific question unlike in secondary data where a proxy for say size might represent a number of things ranging from political costs, firm risk to environment influence (Graham et al., 2005). It is intimated that appreciation of a firm's determinants of disclosures through both secondary data and a survey is helpful in setting up any policy on GHG disclosures. Thus, evidence abound that the understanding of firm specific determinants is of paramount importance in helping identify and highlight challenges or obstacles to the success of future regulatory efforts (Peters and Romi, 2010). Tauringana (1997) also pointed out that one importance of disclosure is that they help recommend or influence policy. But policy adoption itself is as a result of the application of a choice among several alternatives and often a highly subjective judgemental process which in the opinion of Graham et al. (2005) can only have a sound grounding if supported by empirical evidence emanating from primary data. In the circumstances, one contribution of this research is that its results will help shape policy on GHG disclosures at a time when the government is stepping up efforts to ensure more GHG disclosures by companies (Defra, 2010).

Methodologically, related to the use of primary data, the other contribution of the study comes in its longitudinal setting. The relevance of longitudinal studies is well

documented in literature. Brammer and Pavelin (2006) noted that a longitudinal study helps to highlight an evolving pattern of disclosure over time and the results of Rajab (2009) on risk disclosures in the UK, though done based on random years chosen over time supports this view. Other social and environmental disclosure studies have also displayed an increasing pattern in response to a number of factors specifically regulation and public pressure (Haniffa and Cooke, 2005).

Thirdly, the fact that the results failed to establish a statistical relationship between most governance characteristics and GHG disclosures could be food for thought for authorities responsible for governance as to whether there is need to re-look at how governance can become more encompassing to serve the needs of wider stakeholders. Arguably, the results contribute to growing debate/calls about a rethink relating to what constitutes the 'best practice' in terms of board structure when it comes environmental and GHGs issues (Walls et al., 2013). Wang and Hussainney (2013) argue that it is still debatable as to whether certain governance characteristics as advocated by UK corporate governance guidance are effective in improving narrative reporting in general. Mallin et al. (2013) argues that there is no straightforward path between corporate governance to social and environmental disclosures hence called for innovative techniques of proving the link.

Finally, the study also contributes to the understanding of the extent of GHG voluntary disclosure practices by UK firms in the context of the requirements from a number of GHG disclosure guidance. Although there is burgeoning research on GHG disclosures (e.g., Freedman and Jaggi, 2005; Peters and Romi, 2010; Rankin et al., 2011; Stanny, 2011), most of it is based on only one GHG disclosure guidance (i.e. GRI, 2002). Rankin et al. (2011) criticised the use of one environmental disclosure guidance such as GRI to measure GHG disclosure arguing that it is too limited for quantifying GHG disclosures. Day and Woodward (2009) also made a similar observation regarding GRI (2002) calling it 'a generic' document that does not address a specific sector. It is therefore intimated that by measuring GHG voluntary disclosures based on a number GHG disclosure guidance is more appropriate in that it will show the extent to which UK firms disclose internationally recommended GHG information on a voluntary basis.

1.7 Limitation of Study

The study's main limitation lies in the sample size and response rate of the survey questionnaire. The exclusion of financial companies coupled with exclusive focus on UK

only meant the ability of generalising the results is limited. The sufficient but low response rate also meant that the study was limited on the extent to which triangulation could have been performed.

1.8 Structure of the Thesis

The thesis comprises nine chapters which are organised as follows. The present chapter (chapter one) gives an overview of the research while chapter two presents the different theoretical frameworks within which voluntary disclosures have been investigated. Thus the main principles of the theories and their suitability to the current study are discussed in this chapter. Theories discussed include agency, stakeholder, legitimacy, signalling and institutional theory. Through the theories, the chapter attempted to highlight whether both information asymmetry and social political pressure can explain the voluntary nature of GHG disclosures.

Chapter three discusses existing literature on the determinants of voluntary disclosure in particular environmental and GHG emissions. In this chapter a list of determinants i.e. governance and firm characteristics as drawn from previous studies is presented and their applicability to current study analysed. The chapter also notes areas where the literature has been limited and merits further research like the present one. What is apparent in this chapter is the lack of empirical studies investigating the GHG emission voluntary phenomenon in the UK. In the same vein it is noted that since the GHG disclosure are still emerging, little attention has been given to disclosures in annual reports, sustainability reports and websites instead the majority has concentrated on CDP reports. In particular the chapter has also documented absence of studies testing primary data in relation to GHG voluntary disclosures.

Chapter four was dedicated to discussing the nature and importance of GHGs. It tracked down the science behind GHGs, their social and economic consequences on humanity and efforts taken both local and international to decisively deal with the emission problem. In discussing the science behind global warming, due recognition was made to the criticism levelled against the threat of global warming. By highlighting specific features of GHGs and international efforts to reduce them, the chapter intended locate the role of reporting or disclosures in light of nature of the GHGs. The last part of the chapter is dedicated to discussing UK efforts in dealing with climate change and strategies put in place to reduce emissions.

In chapter five a discussion of the various reporting frameworks for GHG emissions is

presented. Being a voluntary disclosure study, concentration is only on those frameworks that are not mandatory. The differences and similarities of these frameworks are analysed and this leads to the construction of the disclosure index used in the current study.

Chapter six details the methodology used in this study. To begin with the research philosophy underpinning the study is identified and briefly discussed and then the population, sample and data description is given. After the data description, different aspects of the research index methodology are explained. The justification for the disclosure index drawn is also described. Various statistical tests undertaken to ensure data normality have also been explained. Thereafter the nature of the primary data and questionnaire used to collect the same is explained. A description of ethical issues surrounding the survey and the pilot study conducted wind up the chapter.

Chapter seven discusses the main hypotheses to be tested in the study. The hypotheses are discussed and drawn based on the literature covered in chapter two and the theoretical framework presented in chapter three. In total, a list of eleven hypotheses based on board size, non-executive directors, audit committee, environmental committee, ownership concentration, director ownership, company size, gearing, profitability, liquidity and industry has been presented. The model and definition of the variables are also explained in this chapter.

Chapter eight discusses the results of the both the econometric model and the survey questionnaire. Descriptive statistics aimed at exploring the parameters of the data set have been presented and this leads to a detailed discussion of the main regression results as well as other alternative models. Thus as part of robustness, other alternative models were explored and these include decomposition of the dependent variable into qualitative and quantitative disclosures and another model containing a transformed industry dummy variable. After discussing the secondary data results, the chapter goes on to present results from the survey questionnaire. Based on the respondent sample, a regression model is run and the comparison of the results is carried out at the end of the chapter.

Chapter nine summarises the whole thesis with particular focus on methodology and results. It then discusses contribution; implications and limitations of the research and finishes by suggesting avenues which future research might concentrate upon.

CHAPTER TWO

Theoretical Framework behind Disclosures

2.0 Introduction

Evidence from prior studies suggest that firms disclose environmental and GHG information due to a number of incentives (Gray et al., 1995a). Indeed, a number of theoretical frameworks have been used to understand the phenomenon of disclosure incentives and explain the managerial motivations to disclose beyond what is required by say legislation. There is however an admission that no single theory satisfactorily explains the motivations or determinants as such some researchers have had to rely on a number of theories to explain the phenomenon while others have had to choose a theory based on their hypothesis (Freedman and Stagliano, 1992; Linsley and Shrives, 2000; Ntim and Soobaroyen, 2013). Both Adrem (1999) and Cormier et al. (2005) point out that disclosures are a complex phenomenon that cannot be explained by one single theory. Nonetheless, though the theoretical frameworks used differ, the outcome regarding the disclosure motivations have consistently pointed to similar conclusions hence arguably underlying the fact that theories do not tell a researcher what to do rather they highlight what is possible to do and not. In the circumstances, this thesis will adopt a number of theories in attempting to explain the determinants of voluntary GHG disclosures. Despite this, however, emphasis will be placed on those theories which are deemed relevant in explaining GHG disclosures since though theories are complementary; they are not equal in their interpretation capabilities of a particular phenomenon (Van der Laan, 2009).

Regardless of the subject of the disclosure study, empirical research results largely explain that the desire to overcome information asymmetry problem, signal quality and knowhow, meet stakeholder expectations and gain society acceptance are among the significant forces behind disclosure decisions. A well informed market is believed to benefit a firm through lowering cost of capital and debt while good cooperation with stakeholders and society is deemed critical in securing going concern prospects of a firm.

In this thesis which focuses on the extent and determinants of GHG disclosures in the UK, a number of theories for instance legitimacy, stakeholder, agency, signalling, and proprietary cost will be used to understand what motivates firms to disclose GHG information in a predominantly voluntary environment. Environmental and GHG disclosure

can be construed as part of dialogue between a firm and its stakeholders and as a way of gaining society approval (Gray et al., 1995a). This is arguably important in the present era when climate change has become both socially and politically sensitive. Such disclosures can also help overcome the information asymmetry problem currently synonymous with environmental and GHG issues. Thus there is evidence of information gap between firms and their stakeholders notably investors who are increasingly demanding more information on climate change and GHG emissions. Understanding how firms are minimising the information asymmetry problem to benefit their companies through accurate valuation of their companies will also help illuminate the tension brought by proprietary costs of disclosure that can potentially shape the disclosure decision. Since companies do not exist in a vacuum, the influence of its operating environment on its disclosure decisions can also be paramount as such this can be analysed by institutional theory.

The rest of the chapter is dedicated to a detailed discussion of the theoretical frameworks for disclosure. Theories covered are legitimacy, stakeholder, institutional, agency, stewardship, signalling, and proprietary cost. Within the discussion of the theories justification is made as to why some theories are particularly useful in the study of voluntary disclosures of GHG information taking into account their usage in prior studies and the particular features of the subject matter i.e. GHGs. At the end, a summary of the chapter is presented.

2.1 Legitimacy Theory

Despite being widely used by social researchers in explaining disclosures, legitimacy theory is a seldom known phenomenon prone to many varied interpretations. This concurs with the observations of Hybels (1995) who observed that many use legitimacy theory but few define it. But according to Suchman (1995 p 574)

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

Earlier, Lindblom (1994) defined legitimacy as a condition conferred upon a firm when its value system is congruent to that of the society. The fundamental element in both definitions is that legitimacy only exists when a firm's actions are deemed acceptable in the society in which it is part of. Therefore, legitimacy theory emphasizes the importance of societal acceptance in ensuring a company's existence and survival (Ghazali, 2007). The author argues that an underlying assumption of legitimacy theory is the belief that a

company's actions can intentionally or unintentionally have an impact on the surrounding environment in which it operates, and in case a company's activities are perceived to have detrimental or negative effects on the environment, the society may adversely react by boycotting the company's product or pressuring for government intervention. In this case, firms legitimatise their activities through various means, including communication with relevant stakeholders (Ashforth and Gibbs, 1990).

Patten (1992) suggested that legitimacy theory largely relates to the concept of 'social contract' between a firm and the society. The existence of an organisation is threatened if it is regarded as violating the implied social contract. This is usually believed to take place whenever the society members are not satisfied with the behaviour of the concerned company (Milne and Patten, 2002). Failure to comply with society expectations leads to revocation of the contract (Deegan and Rankin, 1996).

Suchman (1995) explained that legitimacy exists in different layers one of which is the macro theory of legitimisation where institutional legitimacy theory falls. The institutional legitimacy theory focusses on how businesses/organisational structures gain society acceptance which then makes their operations/actions be deemed natural and relevant. Below the institutional level is the organisational legitimacy which explains the mechanism within which an organisation seeks approval or avoids sanctions from different groups in a society. Such approval or sanction avoidance is considered necessary to ensure continued existence (Kaplan and Luland, 1991). Within the organisational legitimacy, a firm relationship with its society is seen from a resource dependency framework. In this context, Tilling and Tilt (2010) states that legitimacy just like money is viewed as a resource which the organisation strives to have in abundant supply often through competition. Inadequacy of legitimacy, just like any other resource might lead to catastrophic consequences i.e. demise of an organisation. While other resources are firmly under the control of the firm, legitimacy is largely controlled by a firm's collective stakeholders. This then means that in search of legitimacy, an organisation should identify how each stakeholder influences the flow of resources crucial to the organisations' establishment, growth, and survival. Critical stakeholders identified in literature are media, public, financial community and the state. Disclosure literature has recognised that one of the reasons companies try to manage their legitimacy is because it 'helps to ensure the continued inflow of capital, labour and customers necessary for viability' (Neu et al., 1998, p. 265).

Since legitimacy is a significant determinant of a firm's going concern, it is deemed

as more of a process rather than an end in itself as such a firm goes through various stages of gaining legitimacy. The first stage is that of establishing legitimacy and this is gained through competency, customer service, adequate financial resources (see Tilling and Tilt, 2010) and more importantly through meeting socially constructed standards of quality and desirability as well as performing in accordance with accepted standards of professionalism (Hearit, 1995). After establishing legitimacy the next stage is maintaining legitimacy and this is done through maintaining performance and providing assurance of going concern and overcoming any potential obstacles (Ashford and Gibbs, 1990). Tilling and Tilt (2010) notes that society needs are dynamic and change over time as such maintaining legitimacy means that a firm's performance keeps pace with these changes. In demonstrating its dynamism and responsiveness to society changes, a firm makes a number of disclosures as a means of communicating with society (Tilling and Tilt, 2010).

As firm activities respond to society changes, a need may arise to extend legitimacy. This is a third stage and is considered crucial in winning confidence of 'wary potential constituents' (Ashford and Gibbs, 1990). The final phase is the defence legitimacy where a firm provides responses when its legitimacy is threatened or challenged (Tilling and Tilt, 2010). This is a phase that is common to most organisations because as Hearit (1995 p.3) noted, in a capitalist society, '*Satisfaction of stockholder interests often occurs at the expense of community concerns while, conversely, responsibility to the larger community often occurs at the expense of the stockholder'.* In defending its legitimacy, Lindblom (1994) identified four strategies which a firm can use as follows: Change itself (The organisation seeks to inform and educate the 'relevant publics' about actual changes within the organisation); change the public (The organisation seeks to change the perceptions of the 'relevant publics', but does not see a need to change its own behaviour); manipulation (The organisation seeks to deflect attention from issues of concern to other issues. For instance, highlighting links with charity); and misrepresentation (The organisation may go as far as not being totally truthful about its activities that are of concern to the 'relevant publics').

Generally what triggers an organisation action in defence of its legitimacy or gaining one is the expectation gap that exists between its activities and society norms/expectations. O'Donovan (2002) explained that legitimacy expectation gaps can occur in a number of ways including a situation where a firm performance has been consistent but society tastes/expectations have changed due to evolving pattern of times. Hrasky (2012) argued that climate change falls in this category because firms are challenged to change course as issues

of climate change have risen in prominence in the society. Ihlen (2009) argued for the need to close the legitimacy gap that had been brought by increasing awareness of climate change issues by society. In the circumstances, Hrasky (2012) argued that legitimation response is required not because companies have altered the nature of operations but society/stakeholder tastes and awareness had implicitly altered the social contract existing between a firm and society. While climate change poses both direct and indirect risks to a firm as identified by Lash and Wellington (2007), Hrasky (2012) argued that it is the indirect risk brought by threat of regulation that might trigger legitimacy responses. There is growing evidence that firms are influenced by its stakeholders to incorporate environmental and sustainability issues in their strategic plans as a way of gaining legitimacy (Bouteligar, 2009; Sprengel and Busch, 2011). Unerman (2008) explained that as stakeholder concerns about environmental issues increased, corporations were being forced to change their strategies as a matter of enhancing their reputation.

According to Suchman (1995), through its forms of responses, an organisation can gain three forms of legitimacy namely Pragmatic legitimacy; Moral legitimacy and Cognitive Legitimacy. Pragmatic and moral legitimacy involve and rely on discursive interaction with organisation audiences and this is where disclosures come in. Pragmatic legitimacy thrives on making attempts to win the support of organisation audiences and this may take the form of presenting an image of an organisation that is truthful and trustworthy and promoting values highly regarded by the audience and this is where firm efforts might be mere symbolism. Moral legitimacy is one that comes out of a positive assessment of an organisation's activities by its stakeholders. Suchman (1995) subdivides moral legitimacy into two as follows: consequential legitimacy where stakeholders regard an organisation as legitimate by judging what it has actually achieved and procedural legitimacy where legitimacy is accorded based on the means/strategies used to achieve the end result. In the circumstances, if an organisation is to use disclosures as a means of gaining moral legitimacy then it is required that the disclosures reveal both the outcomes and the processes used to generate the outcomes (Hrasky 2012).

Therefore it is in the context of both moral and pragmatic legitimacy responses that the need for assessing the legitimacy intent of disclosures becomes an issue. In cases where disclosure take the form of attaining legitimacy symbolism, then an organisation actual activities remain shrouded in secrecy despite being viewed as open to reporting. This leads to less scrutiny by stakeholders.

Empirically, the legitimacy theory has been tested. Particularly, in light of the resource based view, researchers tend to conclude that the survival of an organisation depends on legitimate standing in a society (Deegan and Unerman 2011; Dowling and Pfeffer, 1975). It is intimated that those deemed legitimate are considered trustworthy and hence deserve the support of the society while those who lack legitimacy are deemed less trustworthy and hence cannot easily access society resources (Hrasky 2012). Corporate legitimacy is seen in the way a firm interact with its society in a bid to fulfil its obligation of the 'society contract'. A firm is deemed in breach of its society contractual obligations if its activities are seen to be inconsistent with society expectations (Deegan 2002). Corporate activities that contribute to environmental damage or climate change constitute those activities that stakeholders may find unacceptable. Firms use disclosure of information in order to shape stakeholder opinion of its activities in its favour so as to minimise its risk of being labelled illegitimate. Some researchers have documented evidence of increasing environmental disclosures in circumstances where a firm's image of legitimacy was at stake (Deegan and Gordon 1996). Patten (1992) reported that after the Exxon Valdez oil spill in Alaska in 1989, firms related to that industry and/or incident significantly increased the amount of environmental disclosures in their annual reports immediately after the spill. Deegan et al. (2002) found evidence that when there is growing public concern in a particular sector and firms are becoming under public pressure through media reports, they resort to increasing disclosures as means of demonstrating their legitimacy. The need to gain legitimacy in environmental matters is important because as Berrone and Gomez-Mejia (2009) argued, environmental legitimacy comes with it increased access to resources and improved exchange conditions with suppliers and more importantly protection from society scrutiny which reduces the risk of society sanction.

In addition, the theory has also been relied upon in climate change and GHG disclosure studies. Freedman and Jaggi (2005) in their study of the impact of Kyoto protocol on GHG disclosures argued that legitimacy was most befitting theory for disclosures because results of previous studies have been consistent with the proposition of this theory and hence it was the fundamental basis in their study of GHG disclosures in which results confirmed the same. Anbamozhi et al. (2011) also backed the views that the theory help explain GHG disclosures arguing that the public has now come to rely on words and numbers in annual reports as proxies of communication mode in which a company establish legitimacy. Again, KPMG (2008) survey noted increasing levels of climate change disclosures which reflected

the growing prominence of climate change issues in the society. However, there was an observation that disclosures were of wide variety and type. Hrasky (2012) suggested that the variations which KPMG (2008) reported could be a reflection of the nature of legitimation responses which differs from firm to firm. In legitimation responses, Hrasky (2012) states that responses can either reflect measures taken within the firm or mere symbolism without action on the subject matter. Other studies have reached similar conclusions. For instance Soobaroyen and Ntim (2013) concluded that '*corporations adopt a combination of substantive and symbolic disclosures in a bid to achieve specific types of organisational forms of legitimacy and this mix of substantive and symbolic disclosures is altered as a result of changes in contextual events, stakeholder salience and the corporation's current state of legitimacy'*.

This seems to be a common practice in the environmental and climate change disclosures. For instance, Kolk et al. (2003) found evidence that despite the increase in social and environmental disclosures, the majority of the disclosures were merely statements of intent and concerns rather than reflecting actions done by the firm. The same was with carbon disclosures which according to CDP (2009) were little informative and highlighted disparities between what companies were seen to be doing through the disclosures and what actually science demanded in cutting emissions. Prior to CDP (2009), Kolk et al. (2008) in a study of CDP disclosures of Global 500 from 2003 to 2007 noted that information disclosed by firms was inadequate to investor needs explaining that in most cases firms did not go beyond merely responding to the questionnaire. Stanny (2011) likened the CDP disclosures to the analogy as described by Hopwood (2009) that firms may just use it as a corporate veil simultaneously providing a new face to the outsiders while hiding the true picture of an organisation. Stanny (2011) interpreted this as a confirmation of legitimacy theory since firms disclose the minimum possible just to meet stakeholder expectations and gain legitimacy (Cho and Patten, 2007).

Notwithstanding the fact that legitimacy theory helps to provide useful insight into the disclosure behaviour of companies, there is observation by some researchers that the theory is still underdeveloped as such very difficult to use it in making specific predictions (Owen, 2008; Mobus, 2005). Thus the fact that the theory relies on management perception of the social contract (which differs greatly depending on individuals) means its predictive ability is limited to the extent of the managerial perceptions. Even in circumstances where managers agree that there is legitimacy threat, reasonably it is expected that different managers will adopt different strategies on available options which again makes predictability difficult.

Deegan (2002) argued that there are many 'gaps' not explained by the theory like whether in practice legitimating activities really work and in what form should they be communicated. Further, despite heavily relying on the concept of 'social contract' the theory is vague in explaining how managers become effectively aware of the community concerns and hence the terms of the purported 'social contract' (Owen, 2008). But Gray et al. (1996) indicates that the explicit terms of the social contract can be specified by legal requirements yet as Deegan (2002) the implicit terms of the same remain unspecified and this may be a subject of managerial instinct.

Besides there is still uncertainty as to how managers can determine whether 'relevant publics' are conferring the much needed legitimacy (Deegan, 2002). Moreover others argue that the emphasis on 'relevant publics' means a shift in focus on the society as a whole as suggested in social contract to paying attention to particular segments of the society which in effect is the domain of stakeholder theory. Considerably the fact that emphasis is placed on 'relevant publics' suggests that the notion of a 'homogeneous society' as assumed in legitimacy theory does not hold since as Nue et al. (1998) pointedly argued that in a society some stakeholders might be effective in demanding disclosures than others (Laine, 2009). Legitimacy theory is also considered inadequate in explain the nature of the disclosures as to whether they promote transparency and accountability. In this respect Deegan and Rankin (1996) argued that sometimes legitimising activities might be very misleading as managers are intentionally manipulating public perception. Indeed results from some prior studies like Guthrie and parker (1989) and Adams et al (1995) suggest that legitimacy theory fails to sufficiently explain the levels of disclosure or non-disclosure of environmental information.

Limitations aside, legitimacy theory helps explain partly the motivation for disclosures and so it still remains a viable theory for voluntary disclosures. Deegan (2002) argued that legitimacy theory, while in need of some refinements, provides a foundation for understanding how and why managers might use externally-focussed reports to benefit an organisation. Climate change being an issue affecting the world society as a whole and demanding transparency and accountability on every player, this thesis will rely on legitimacy theory to understand the motivation behind voluntary disclosures.

2.2 Stakeholder Theory

Stakeholder theory views an organisation as an entity through which numerous and diverse participants accomplish multiple but not always congruent goals. Freeman (1984) work on

strategic management and stakeholder approach is what is believed to have laid the foundation of the stakeholder approach to disclosure studies. Freeman (1984, p. 46) defines a stakeholder in an organization as 'any group or individual who can affect or is affected by the accomplishment of that organization's goals'. Stakeholders are categorised as either primary stakeholders i.e. those who controls resources critical to the survival of the firm (shareholders, creditors, employees, customers, suppliers and regulators) or secondary stakeholders i.e. those with the power to mobilise public opinion for or against a firm (media, consumer advocacy groups and environmental lobby groups) see (Clarkson, 1995).

Ullmann (1985), motivated by lack of a comprehensive theory to explain the motivation behind social responsibility disclosures which led to conflicting results, developed a conceptual framework from the stakeholder theory of management popularised by Freeman (1984). Freeman (1984) conceptualisation of the stakeholder theory was in the context of how an organisation's decision making is to an extent affected by the presence of groups other than stockholders. Building on Freeman's work, Ullmann (1985) attempted to draw relationship among social disclosure, social and economic performance. This was done through a three dimensional model comprising stakeholder power, firm's strategic posture, and firm economic performance. Under stakeholder power, stakeholder influence is linked to level of stakeholder control of resources required by a firm thereby arguing that a firm's response to stakeholder demands will be commensurate to its needs of resources controlled by the stakeholder. As part of response, a firm may use disclosures to manage stakeholder demands. Dierkers and Antal (1985) argued that disclosures of social and responsibility information provide a basis for dialogue with various business constituencies. Strategic posture describes how a firm's key decision makers respond to the call for social demands. A response that include more social responsibility activities is described as active and if a company does not develop specific social programs to meet stakeholder demands then it is described as passive. When the response is active then more disclosures are expected. The third dimension posits that meeting the social responsibility demands is very much dependent on the economic viability of the firm meaning that given certain levels of stakeholder power and firm posture, sound economic performance can determine the social disclosures.

Despite the famous works of Freeman (1983) and Ullmann (1984) on stakeholder theory, some researchers still questioned the theoretical foundation and clarity of the theory arguing that what Freeman had done was merely stating a strategic management technique than developing a viable alternative theory of the prevailing norms of profit maximisation at

the time. In bringing clarity to the argument of stakeholder theory, Donaldson and Preston (1995) explained that the stakeholder theory should be understood to exist in three forms as follows;

Descriptive/Empirical: This is where the theory has been used to explain specific corporate characteristics/behaviours (Brenner and Cochran, 1991; Clarkson, 1991). It places much emphasis on the past, present and future of the organisation.

Instrumental: In conjunction with empirical form, the theory is also used to draw connections or lack of it between management and traditional corporate objective i.e. profitability. Studies in this respect conclude that adherence to principles of stakeholders helps a firm achieve its ultimate objectives of profitability and growth (Preston and Sapienza, 1990; Barton et al., 1989; Aupperle et al., 1985; Kotter and Heskett, 1992). This however does not attempt to explain the cause effect relationship explicitly.

Normative: In this sense the theory is used to define the function of the organisation including identification of moral or philosophical guidelines for the management of a firm (Carroll, 1989; Marcus, 1993). Here the stakeholders are to be treated as an end rather than a means to achieve an end as such they are expected to participate in the future direction of the firm (Evan and Freeman, 1988). The normative argument rests on the contemporary pluralistic theories of property rights like utilitarian, libertarianism, and social contract which when viewed together, post that a property owner does not have the exclusive rights of the property but that the same fundamental rights accorded to the owner also gives other groups a moral right or stake in the company. It is in this respect that the responsibility of management is to select resources and direct resources to obtain benefits for all legitimate stakeholders.

According to Donaldson and Preston (1995), the three concepts of stakeholder theory are dependent on one another in that under descriptive, relationships are explained as observed in reality and this is supported by instrumental perspective which asserts that if certain practices are performed then certain expected level of results can be attained. The authors, however, argue that the foundational basis of the theory is normative perspective since the descriptive accuracy of the theory assumes that the normative concept is correct. However, when pursuing the moral obligations of satisfying various stakeholders interests in a company in order to achieve the ultimate aim of improving a firm's financial performance, what is of prime importance is having the various stakeholders assured that their interests are being met. Hill and Jones (1992) suggest that one way this may be done is through

monitoring devices like public reporting that reduces the information asymmetry problem. The monitoring is meant to curb the opportunistic behaviour of managers which might disadvantage other stakeholders. However, as noted by Donaldson and Preston (1995), for the concept of aligning managers interests to those of other stakeholders to work then there is need for managers to operate within the concept of normative stakeholder theory which recognises that moral goals for an organisation are equally important in the realisation of the ultimate goal of profit maximisation.

Therefore, in the circumstances, the basics of stakeholder theory state that a firm's success is not only dependent on managing its relationship with shareholders but rather a group of stakeholders with shareholders being a significant part of this group. In managing stakeholders a firm needs to take into account a number of their concerns one of which could be relating to environment/climate change. In managing stakeholders, Kent and Chan (2003) advises that a firm needs to differentiate between social issues and stakeholder issues because what matters in a firm/stakeholder relationship is the consideration of issues affecting a particular stakeholder rather than the whole society.

Considerably, for a viable firm-stakeholder relationship to exist there is need for accountability on the part of the companies not only to shareholders but to other stakeholders as well. From an accounting perspective, accountability refers to the responsibility of an organization to disclose information regarding its performance, financial position, financing and investing, and compliance in order to assist users to make appropriate decisions (An Australian Accounting Research Foundation (1990) cited An et al., (2011). In aiding accountability, the stakeholder theory has two branches namely the ethical (moral) branch and the positivist (managerial) branch (Gray et al., 1995a). The ethical branch is where all stakeholders have certain intrinsic rights (e.g. fair treatment) that should be protected by the organization, and the management should engage in activities for the benefits of all stakeholders (or seek to satisfy the demands, needs and expectations of all stakeholders) (Deegan, 2000; Deegan and Samkin, 2009). In this branch of stakeholder theory, the emphasis is on equal treatment of stakeholders hence an organisation is expected to disclose same information to all stakeholders even if a particular stakeholder is not interested in using it (Deegan and Samkin, 2009). The positivist (managerial) branch states that an organization needs to identify the group of stakeholders with a focus on those considered to be significant or powerful to the continued viability and success of the business (Roberts, 1992; Watts and Zimmerman, 1986).

Such identification is considered critical because as Mitchell et al. (1997) put it, it is not the equal consideration of all stakeholders interest that pays off rather it is the selective focus of the interests of those stakeholders with higher levels of power, legitimacy and urgency that help a firm manage its stakeholders. Therefore according to Gray et al. (1995a), the use of stakeholder theory in social accounting research is from the perspective of management who are concerned about a firm's survival. In search for continued existence the firm seek the approval of its stakeholders which change over time and require a firm to keep on adapting its activities to these stakeholder interests. A company thus uses social disclosures as part of managing these expectations (Gray et al., 1995a). Roberts (1992) noted that CSR was being used successfully as a medium of managing stakeholder relationships.

Precision as to how the firm-stakeholder relationship evolves over time is explained from the resource dependency theory. Frooman (1999) used the notion of resource dependency theory and explained that stakeholders can either use withholding or usage strategies in trying to force a firm align to their interests. Withhold is simply discontinuing provision of the resource whereas usage is by providing the resource with conditions attached. These strategies are implemented in two ways: direct – where a stakeholder directly manipulates flow of resources to a firm or indirect where stakeholders alters their dealings with other stakeholders of a firm like suppliers in a bid to put pressure on the firm. Frooman (1999) then identified four power levels in which a relationship between a firm and its stakeholders might exist. Elijido-Ten et al. (2010) summarised them together with the choice of strategies adopted as below:

(1) Low interdependence – when neither the firm nor the stakeholders are dependent on each other. In this case the stakeholder will choose indirect withholding strategy to influence the firm.

(2) Firm power – when the stakeholder is dependent upon the firm. Here the stakeholder will choose indirect usage strategy to influence the firm.

(3) Stakeholder power – when the firm is dependent on the stakeholder. In this case, the stakeholder will choose direct withholding strategy to influence the firm.

(4) High interdependence – when the firm and the stakeholder are interdependent. Here the stakeholder will choose direct usage strategy to influence the firm.

It is assumed that a firm will only respond to stakeholder demands depending on how their relationship depends on each other in terms of resources. Therefore to maximise their outcome it is incumbent upon stakeholders to choose the right strategy of enforcing a firm to

act in their interests. Frooman's analogy implies that the lower the level of stakeholders' dependence on the firm, the more likely that the stakeholder can afford to withhold a critical resource (Elijido-Ten et al., 2010). Disclosure of information is seen as one way in which firms respond to the stakeholder demands meaning that when the more powerful stakeholders demand more accountability, there is high probability that the firm will increase its disclosures to meet the demands. Nue et al. (1998) documented evidence to the effect that organisations were responsive to the demands of the more powerful 'relevant publics'. Tang and Luo (2011) also hypothesised using stakeholder theory and argued that variation in disclosures is partly explained by an organisation's efforts to match stakeholder influence and power which vary over time. They further articulated that the theory's explanatory power is enhanced when seen as being complementary to legitimacy theory since the core incentive of managers in engaging stakeholders is to gain legitimacy.

Despite its wide popularity and further attempts to clarify the theory, there is still some criticism as to the validity of the stakeholder theory. As pointed out, critics argue that there is still no theoretical background for the influence of stakeholders on a firm noting that what Freedman (1984) did was to simply develop a management technique. While stating that the economic model of the firm had failed to accurately explain the behaviour of a firm, Freeman(1984) did not provide an alternative theory to explain the phenomenon that a firm is beyond the concept of a 'resource conversion entity' impacted by both internal and external actors (Key, 1999). Thus apart from identifying the existence of internal and external parties to a firm, stakeholder theory as conceptualised by Freeman(1984) fail to explain the dynamics existing within these relationship as is expected of any theory. Hence since stakeholder theory provides new framework without logic and causality of the variables then it cannot be relied upon to explain or predict the behaviour of a firm. Realising this inadequacy, other researchers like Donaldson and Dunfee (1994) and Jones (1995) have suggested that stakeholder theory rests on the foundation of contract theory. Donaldson and Preston (1995) also tried to attach the theory of property rights to stakeholder theory and stated that stakeholder theory could only be fully explained in normative perspective. But Weiss (2000) even questions the rationale of attaching property rights theory to stakeholder noting that in a capitalist society an individual has the right to set up business and operate without further sanctioning by society and that in the event society or the member of the society i.e. stakeholder feels hard by the actions of the firm then they have the right to legal redress. In this set up it means the company's moral obligation is the same any member of the

society is expected to abide by hence no need to place moral restrictions on the exclusive rights of company owners.

In addition, the fact that some stakeholders have the ability to relate to the firm in multiple forms (e.g. an employee can also be a consumer or a member of an association that deals with the organisation at the same time) means that mere identification of their existence as done by Freedman gives little insight of what actually happens in practice. Rowley (1998) suggested viewing stakeholders as a network while Donaldson and Preston (1995) suggested identifying stakeholders according to their interests noting that in practice it is difficult to categorise stakeholders just by the existence. The stakeholder theory does not also take into account the full effects of the environment on a firm instead it arguably over assumes that a firm's environment is its stakeholders. Thus preoccupation with stakeholders has made the stakeholder theory unable to take into account the impact of environment on the business. The theory actually presents a firm as being in control of its surrounding and hence sets itself in sharp contrasts to other theories like institutional theory as developed by Dimaggio and Powell (1983).

Despite the criticism however, stakeholder theory has been widely used by social researchers. Key (1999) attributes this to the fact that the theory provides clarity as to whom a firm is responsible. Thus though it has previously been recognised that there is gain in demonstrating awareness to operating environment needs but questions still remained as to whom this awareness should be directed and this was clearly addressed by stakeholder theory.

The need to identify particular stakeholder interests needs no emphasis since in practice the interests of stakeholders conflict and overlap and hence it is left to management to resolve the conflicts and balance the overlaps (Jensen, 2001). For instance, the area of environmental performance is often in conflict with profitability (Macve and Chen, 2010). Tang and Luo (2011) added that the changing pattern of the operating environment also means that management should master the art of balancing both short term goals and long term success of business noting that changes in say regulation/public opinion in sensitive areas like carbon and environment might mean a change of power in stakeholder hierarchy necessitating adjustment of firm response to stakeholder demands.

Climate change and indeed management of GHGs require careful consideration of stakeholder expectations. Consumers are becoming increasingly aware of the devastating impact of GHG emissions as such are demanding firms to be environmentally responsible in

their activities. Investors are demanding all risks relating to climate change be accounted for and disclosed properly. The CDP is a demonstration of their quest for more information on climate change. Regulators, while grappling in the dark as to what viable option to adopt in the fight against climate are always keen on understanding what firms are doing to control emissions so as to determine where policy intervention might be needed to compliment firm efforts. Particularly in the UK, the CCA (2008) required the UK government to assess whether reporting of GHG emissions be mandatory as a way of consolidating efforts in the fight against climate change. The fact that other studies for instance Freedman and Jaggi (2005) found influence of a country's commitment to Kyoto on climate change disclosures means that firms must always take into count the changing demands of government as a stakeholder. A number of lobby groups exist aiming at forcing firms perceived to be irresponsible polluters to change their behaviour. This then means that while a firm might have a number of initiatives meant at enhancing its legitimacy from the society as whole, such initiatives might only be beneficial to a firm if they successfully consider the demands of stakeholders carefully.

2.3 Institutional Theory

Institutional theory as used in organisation research is believed to be based on the foundational works of Zucker (1977), Meyer and Rowan (1977) and DiMaggio and Powell (1983). The theory is premised on the assumption that organisations respond to pressures from institutional environments and adopt structures/procedures that are being socially accepted as being appropriate. Zucker (1977) primarily addresses the notion of how authority become institutionalised within and organisation whereas Meyer and Rowan (1977) argued that organisational choices are often not a reflection of efficiency but rather an attempt on the part of the organisation to act in the generally accepted manner which helps the organisation to defend itself against perception of irrationality. The informal institutional pressures emanate from industry leaders, peers and networks and help a firm to align its behaviour to those prevailing within its environment. In this respect, Pfarrer et al (2005) suggested that faced with uncertainty regarding the consequences of certain firm behaviour, a firm might often take a lead from how industry peers have dealt with the same situation.

With the organisational tendency to conform to predominant norms and traditions, the theory predicts that such behaviour will lead to homogeneity in structures and practices by organisations and that the same will be considered legitimacy benchmarks for any player

within the industry. This similarity in form and processes is what DiMaggio and Powell (1983) termed as 'Institutional Isomorphism'. However it should be highlighted that the social structures and processes in the understanding of institutional theory gain meaning and stability in their own right without due consideration to the ultimate end of the processes (Lincoln, 1995). This then means that firms in particular industry might have similar reporting pattern of say environmental issues merely to hedge against criticism but not to improve accountability or management of the impact of their activities.

DiMaggio and Powell (1983) categorised the pressures faced by organisations into three namely mimetic, coercive, and normative. Mimetic forces are pressures to copy other organisations activities, systems, and structures and this arises when there is uncertainty or no clear course of action. The uncertainty leads a firm to check competitor/peer actions and some researchers have documented evidence that in uncertain times, firms tend to copy after similar but larger or successful firms (Deephouse, 1996; Haveman, 1993; Greve, 2000). Ashworth et al (2007) explained that Mimetic forces are often behind the adoption of certain management practices for which there is little empirical evidence of performance benefits. Considerably this means that when industry leaders chart a course of action regarding a particular threat or new phenomenon facing their industry, other firms in the same industry might respond by simply imitating what these industry leaders are doing. Suchman (1995) argued that firms may be motivated to imitate a particular practice even if it has un known economic benefits because of the desire to gain social legitimacy which help guarantee the long term survival of the firm. According to Lewis et al. (2013), the decision to disclose, is both fraught with uncertainty and strategically important as the information is relevant to and acted upon by investors, customers, regulators, and non-governmental organizations. With climate change, reporting of GHGs by firms in a particular industry might therefore follow a similar pattern as a result of mimetic forces.

Coercive forces refer to external pressures exerted largely by regulatory regimes or other agencies on a firm to follow a prescribed preferred system. The pressure might also be as a result of contractual obligations restricting a firm to act in a particular pattern. These forces symbolises political pressure rather than technical pressure. Scott (2001) noted that the state's ability to impose its will upon organizations through the use of sanctions is a major regulatory mechanism of control and one that can induce conformity. Arguably, in the UK, the introduction of DEFRA (2009) could be seen as a form of political pressure into indirectly forcing companies to adopt a particular preferred form of reporting GHG emissions

even if the guidelines are voluntary. There are however arguments to the effect that coercion might deter voluntary action by companies. Thus in circumstances where non-compliance is punished firms may opt to hide deviant behaviour for fear of experiencing similar punishment like colleagues thereby making coercion counterproductive (Pfarrer et al., 2005).

Normative forces are those pressures emerging from professional standards or a professional community within the network of the organisation. These forces highlights the fact that a firm is expected to conform to professional standards deemed legitimate in a particular field in which the firm operates. These standards are communicated through education and specialised training and accreditation. Professional ties or networks within an industry acts as self-policing mechanism and has what Abrahamson and Rosenkopf (1997) termed 'trickle down' effect which makes the firms be persuaded to pursue similar actions as their colleagues. Eldman et al. (1992, 1999 cited Pfarrer et al., 2005) found evidence that professionalism ties in the legal field had helped diffuse informal practices regarding firm arbitration procedures into de facto 'laws of the land' even though no formal laws regarding these procedures had ever been passed.

There is some criticism to the theory. Critics warn that emphasis on the fact that over time due to imitation organisations become identical assumes that organisations are passive recipients of their environments which is not the case in reality (Suddaby, 2010). In fact DiMaggio (1988) warned on the overemphasis by some researchers to explain organisational similarities using institutional theory arguing that organisations are not prisoners of their environments and that through entrepreneur spirit organisations can satisfactorily respond to its operating environment demands.

There is also criticism that institutional theory does not go far incorporating the role language and individuals can play in organisational processes. Thus both persuasive language and the nature of individuals assuming various roles in an organisation can affect its response to the environment. In this respect, institutional theory is criticised for predominantly concentrating on external influences on an organisation while neglecting the internal factors/dynamics that might affect whether an organisation will align to its environment or not. This is supported by the views of Rao and Giorgi (2006) who explained that organisations are interpretive mechanisms that filter, decode and translate semiotic social systems. Institutions are replicated through periodic activities of individuals as such the role of humans in organisational reaction to its environment needs no emphasis. Evidence emerging from current research suggests that managerial characteristics play a crucial role in

determining how an institution react to its external pressures more especially those relating to environmental issues (Lewis et al., 2013).

Criticisms aside, literature has evidence that based on institutional theory, mimetic, coercive, and normative forces influence firms to adopt environmental strategies including reporting (Lewis et al., 2013). Scot (1995) stated that environmental reporting could be deemed as a structure and practice that become institutionalised over time. Cormier et al. (2004) argued that adoption of an environmental policy by industry leaders might force other companies to follow suit whether symbolically or genuinely. Such adoption might be in line with mimetic action by a firm and not a reflection of economic driven choices. Environmental reporting is more susceptible to imitation because due to its sensitivity, managers might opt to imitate industry leaders/peers as a way of deflecting criticism on their practices. Reid and Toffel (2009) find that firms in the same institutional field react similarly to activist groups and government pressures while Cho and Patten (2007), note that firms operating in more environmentally destructive industries are more likely to provide significant disclosure of their environmental performance. In a study of the determinants of environmental disclosures in 337 firm year observations German firms using multi-theoretical lens, Cormier et al. (2004) tested the influence of institutional pressures. The authors found that among other things, environmental disclosure quality was conditioned by the industry and that imitation and routine determined the disclosure quality as well. The results also indicated that the companies' environmental reporting had a converging pattern over time and that companies were more interested in disclosing pollution abatement information than other environment information. Another study by Sampaio et al. (2011) investigating the influence of Vale S.A. mining company disclosures on the other companies in the industry, noted that indeed the disclosures of the company had significant influence on its peers disclosures. Their study analysed 45 annual and sustainability reports of Brazilian companies over a five year period i.e. 2005-2009 using regression analysis.

In the circumstances, in this study it is considered that institutional theory will have tremendous influence in determining GHG disclosures. Climate change being a sensitive area and seemingly costly to institute management systems to manage and report, the temptation on the part of the managers to imitate disclosures practices from industry peers is high. The current set up regarding mechanism combating climate change makes a recognition of the fact that other industries are carbon-intensive as such much in terms of mitigating efforts is expected from them. Therefore this suggests that the influence of industry practices on

disclosure of GHG information is paramount. Besides, there is a wide variety of voluntary disclosure guidelines which if companies adopt different guidelines might result different patterns of disclosures. Hence, arguably any similarity of the disclosures in companies over time might be explained by institutional theory.

2.4 Agency Theory

Agency theory discusses the impact of the principal-agency relationship arising due to separation of management and ownership (Jensen and Meckling, 1976; Morris, 1987). Delegation of authority is the dominant characteristics of the modern day organisation. This has made it possible for security holders (shareholders and debt holders) to be different from those who manage the organisations thereby leading to an 'agency relationship'. Jensen and Meckling (1976), defined agency relationship as:

.....a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent.

Two main assumptions underpin the agency theory namely: Individuals are of utility maximisers hence given an opportunity, agents will pursue actions that maximises their personal welfare at the expense of principals and; that individuals are rational and capable of taking unbiased decisions. Rationality then implies that individuals take into account the self-interested motivations of others in their decision making.

Based on the assumptions, the agency theory states that if the individual's acts are guided by self-interest then differences in self-interests will produce conflicts which result in agency costs being incurred by the parties involved. In a shareholder-manager relationship, these costs include loss of equity value if shareholders perceive managers to be acting out of line and the costs of monitoring and bonding managers so as to ensure they act in the perspective of the shareholders. Thus going by the agency assumptions, loss of share price is an opportunity loss for managers because it can be interpreted as shareholders reacting to managers' self-interested behaviour and reflecting the same in the price. Other agency costs arise due to the presence of debt holders. These costs are mainly borne by shareholders and they include costs relating to asset substitution and under-investment which might see wealth transfer from shareholders to debt-holders. Like shareholders, debt holders are also rational as such they incorporate these agency costs in the price they pay for the debt.

Initially, the agency costs are assumed to be borne by the shareholders. Therefore, to

mitigate the share value loss and align managerial interests to theirs, shareholders might intensify monitoring managerial behaviour which then results in monitoring costs. The role of monitoring is often performed internally by the board of directors or through use of external analysts who analyse information possessed by management (Healy and Palepu, 2001). But Fama and Jensen (1983) stated that these costs might ultimately be borne by managers since their remuneration might be discounted by the same costs. Realising that monitoring costs is discounted in their remuneration, managers put in place mechanisms to help them act in accordance with shareholder interests with the hope of minimising these costs hence in the process they incur other costs known as bonding costs. Bonding costs may sometimes take the form of providing more information to shareholders. Healy and Palepu (2001) noted that it is always the case that management have more information than outside investors which leads to information asymmetry problem which increases the agency problem. Disclosure of information minimises the agency problem and reduces the agency cost. Managers engage in the disclosures when they perceive that the benefits of disclosure outweigh the costs incurred through the agency problem (Ness and Mirza, 1991).

Nonetheless in practice, effective monitoring has been a challenge for most shareholders. This is so in cases where ownership is highly diffused so much so that shareholders become so dependent on management on their information needs. Apart from monitoring, principals may also design and offer incentives to management to limit the interest diversion (Jensen and Meckling, 1976). These incentives include schemes which tie managerial compensation schemes to firm performance outcome like share price (McColgan, 2001). Thus when part of managerial wealth is tied to shareholder wealth, the agency problem is minimised since both parties have a common goal.

There are also arguments that managers' self-interested behaviour can be mitigated by well-functioning capital and labour market. Share value loss which might trigger a hostile takeover might be a deterrent to managers acting in their own interest. In case of a takeover then an efficient labour market will mean underperforming managers being replaced. But takeovers are sometimes costly and take long time to conclude which then puts their corrective ability in question (Jensen and Rubak, 1983). Others also suggest that there is an internal monitoring mechanism within a firm among various managerial levels because every manager realises that their destiny is tied to the collective performance of the firm as a whole which is normally a contribution from different individuals.

Studies have found that disclosure of information say in intellectual property help a

firm reduce information asymmetry and costs (See Oliveira et al., 2006 and White et al., 2007). Ness and Mirza (1991) tested the social disclosures in 1984 annual reports of 131 leading British companies and found that a positive relationship existed between the oil industry and the environmental disclosures. Their results were seen to be consistent with agency theory in that management were increasing disclosures to improve their welfare.

In this study, while testing the traditional factors of voluntary disclosures as found in literature, emphasis will be placed on the ownership and board structures. This is appropriate because institutional investors have shown keen interest in climate change risks/opportunities and in response firms have been reorganising their boards to reflect the pressure being exerted on them by the former. Such pressures are a reflection of the agency problem notably information asymmetry which then prompts management response. For instance, Peters and Romi (2012) in a study of GHG disclosures argued that creation of structures like environmental committees on the board is one way of trying to overcome agency problem and align shareholder interests to those of managers. They further argued that sometimes creation of these board committees and hiring of specialised positions like corporate sustainability officers could be a way of creating a perception of a firm's sustainability strategy in order to gain legitimacy but not necessarily empowering these portfolios to achieve their goals. This is a form of symbolism. The authors further stated that by merely acting as symbols a firm may not have incentive to disclose more GHG information since the purported structures are achieving their aim. For instance, Rankin et al. (2011) examined the relation between voluntary adoption of environmental committees and the probability of GHG disclosures in Australian firms, as well as the extent and credibility of that disclosure, and find no association.

Nonetheless recognition is made that agency theory has some limitations which might affect predictability of the disclosure behaviour. Band (1992) argued that Agency theory reduces the complex nature of human behaviour in an organisation to a series of contracts between principal(s) and agent and exclusively considers the avoidance of responsibility by agents as self-interested behaviour. This is a huge underestimation of the human dynamics more so that principals are also human beings with their own self-interested motivations. Again in the bilateral contracts envisaged by agency theory, principals are presented as being at the mercy of the agents who appear to know exactly how much he can perform. In reality this may not be the case because in some cases agents gain their useful skills whilst on the job or through specialised training. Such human capacity development is within the influence of

the principal which if used to affect the career progression of the agent can materially alter the nature of relationship between the parties. The mechanisms used to overcome the agency problem have also come under criticism. For instance, the monitoring function meant to limit the managerial self-interested behaviour is performed by the board of directors which is one of the corporate governance mechanisms. However in practice it has been established that the effectiveness of the board is very much dependent on the relative power of the members which in cases of a dominant CEO presence is severely undermined (Band, 1992).

2.5 Stewardship Theory

Stewardship theory, framed largely as a counterweight to agency theory, posits that there is no conflict of interest between managers and owners and that the ultimate aim of governance is to find mechanism and structure that promote the most effective coordination between the two parties (Donaldson and Davis, 1991). The underlying assumption of the theory is that managerial interests are aligned to those of the owners and that managers tend to be benign in their actions (Donaldson, 2008). In this set up the principal stands to benefit since there is lower economic incentives and monitoring which reduces transaction costs on their part.

Like the agency theory, man in stewardship theory is assumed to be rational only that here unlike in agency theory, a rational man is presented as perceiving greater utility in cooperative behaviours than in self-serving interests (Davis et al., 1997). Being a steward, it is believed that the manager has intrinsic motivation and draws satisfaction from achievement of collective rather than individual goals. The emphasis on intrinsic motivation rather than extrinsic motivation implies that the manager acting as a steward will view organisational success as their own.

According to Donaldson and Davis (1991), the decision to act as a steward or agent in a corporate relationship is made by the manager and is shaped by both situational and psychological factors. Situation factors include an involvement-oriented management system or a control-oriented management system; collectivistic culture or individualistic one; low power culture or when corporate governance gives them authority and discretion. Psychological factors include having higher-order motivations, better disposition to identify with the objectives of the firm, value commitment orientation, and greater use of personal power as a basis to influence others (Davis et al., 1997). Apart from these factors, it is also anticipated that the expectation that each party has over the other will influence the nature of the relationship (Pastorizo and Arino, 2008).

With stewardship theory in place, the role of the board, CEO and board chairman in a corporation becomes under scrutiny. Thus where managerial interests are aligned to those of the owners then stewardship theory advocates for the minimal role of the board since board mechanisms like separation of CEO and chairman are put in place as a way of solving agency problems which are 'non-existent' in stewardship theory. In line with strategic management thinking which suggests that shareholder returns could be improved when the CEO is given effective control of the organisation then stewardship theory advocates that the roles of CEO and board chair be occupied by one person (Donaldson and Davis, 1991). In the same vein, stewardship theorists argue that superior corporate performance is associated with the majority of inside directors because they ensure more effective and efficient decision- making which in turn contributes to shareholder profit maximisation (Kiel and Nicholson, 2003). In this respect the theory is in direct opposition to the notion in agency theory which highlights the separation of CEO and board chairman roles as the hallmark of board independence and an indication of improved monitoring. The role of governance mechanisms in stewardship theory is to ensure that executives are empowered to implement plans for corporate performance (Donaldson, 1985). In justifying the proposition of the theory, Donaldson and Davis (1991) investigated whether firms with CEO duality in USA had superior performance to those with separation of roles between CEO and board chairman. Their results failed to provide support for agency theory but provided some support for stewardship theory in that firms with CEO duality had a positive but insignificant influence on firm performance. The authors then argued that the results meant that CEO duality does not in any way negatively affect the performance of a firm.

Stewardship theory has some limitations. The process to which whether to act as an agent or steward is believed to be a product of psychological or situational factors but there is no attempt to explain what happens when the factors conflict and more importantly the underlying mechanism as to what motivates a manager to opt for one position to the other is not explored (Pastoriza and Arino, 2008). The assumption that becoming an agent or a steward is a rational choice made at a single point in time has been questioned in that at what point does one know that they have become a steward and that such simplification undermines the role long term relationship plays in the decision making process of the manager.

2.6 Signalling Theory

Signalling theory fundamentally addresses the problem of information asymmetry in an organisation. In social science studies, the theory is built on the seminal work of Spence (1973) who used the concept of the labour market to demonstrate how job applicants signal to prospective employers. According to Spence (1973), high quality job applicants signal through high education papers and resumes distinguishing themselves from low quality applicants. Thus, the employers lack information about the quality of the applicants as such the applicants acquire education to signal their quality and reduce information asymmetry which often hampers the selection ability of the prospective employers. In this instance, education is used as a means of communicating the unobservable characteristic of the job applicant (Weiss, 1995).

Applying the signalling model in a firm set up, Kirmani and Rao (2000 cited Connelly et al., 2011) categorised firms into high quality ones and low quality ones stating that high quality firms know their quality but such information may not be known to outsiders like customers and investors hence the availability of information asymmetry. The authors then suggested that in these circumstances, a high quality firm is motivated to disclose when benefits accrued to it are higher after signal than would otherwise be and at the same time the benefit of signalling for low quality firm should be lower than would be without signal. Thus the ultimate aim of the signal is to indicate a certain quality which if understood by the receiver, would positively affect their decision making perception of the signaller. Information plays a vital role in the decision making of an individual as such it is believed that in a seller and buyer relationship, a buyer values a product based on the weighted average perception of product which is basically shaped by information he has (Morris, 1987). It is therefore argued that a seller whose products are of a higher quality stands to benefit if she signals the same to the buyer because with such information the buyer values the product appropriately. To be effective, the signal should be difficult to be imitated by the low quality sellers. Signalling will be an iterative process which continues as long as the higher in price obtained exceeds the signalling costs (Morris, 1987).

There are a number of ways in which companies can signal information about themselves. Among those, voluntary disclosure of positive accounting information (e.g. CSR) is considered to be one of the most effective (Ross, 1979; Watson et al., 2002; An et al., 2011). Signalling theory can also be used to achieve the objectives of other theories. For instance a firm can choose voluntary disclosure of information to signal its compliance with

society norms as a way of gaining legitimacy (An et al., 2011). In the same manner a firm can manage the expectation of stakeholders through signalling in disclosures.

The case of signalling could also be behind the voluntary disclosures of GHG information. Firms may be disclosing more to signal to those investors who are looking for credible information regarding climate change risks for their decision making. Berthelot and Robert (2012), in a study of climate change disclosures for Canadian oil companies, partly used signalling theory to predict the behaviour of firm disclosures arguing that a firm with well-founded good news is bound to disclose information voluntarily to differentiate itself from one with bad news. In contrast, a firm which is in possession of information detrimental to itself is unlikely passionate to disclose the same to its stakeholders and more so if the stakeholders are not already aware of such information (Dye, 1985). Disclosures could also be used as a signal to regulators that business are doing enough already and hence no need of intervention in form of regulation in any manner.

Nonetheless, there are a number of weaknesses with the signalling theory. Connelly et al. (2011) argued that though a widely used theory in social sciences, the tenets of the theory are still unknown and requires further development. Again as noted, for Signalling to have a predictive power, the signal must be difficult to imitate. This assumption is derived from the biological sciences where signalling is used mostly in the animal kingdom. Imitation in the animal world is difficult but the same cannot be true in the human controlled corporate world where imitation is the order of the day. The assumption categorising firms as high quality and low quality is also somewhat faulty since in reality institutions does exist in continuum not in dichotomy. Connelly et al. (2011) also adds that the fact that the theory emphasises the intentional signalling of positive information means that the role of unintentional signalling of negative information is underestimated. Spence (2002) argued that in practice parties send a wide range of signals without being aware they are signalling and this could potentially affect the intentional positive signal. Furthermore, the predictive ability of the theory relies on the assumption that the receiver will accurately notice and interpret the signal as originally conceptualised by the sender yet the dynamic nature of the operating environment means that timing and the quality of the signal might affect the interpretive ability of the receiver (Connelly et al., 2011).

2.7 Proprietary Cost Theory

Proprietary cost theory is based on the foundational work of Verrecchia (1983) and posits that companies' ability to disclose information is limited by the presence of disclosure related costs which he termed 'proprietary costs'. Scott (1995) defines proprietary cost as any possible reduction in future cash flows that are attributable to disclosure. The costs arise due to proprietary information which Cormier and Gordon (2001) defined as private information, which is value-relevant to the price of a firm's shares, or debt traded in capital markets.These costs comprise both those incurred in the preparation and disclosure of the information as well as costs associated with impact of decisions made by stakeholders accessing the disclosed information. In his seminal paper, Verrecchia (1983) used the analogy of a manager of risky assets and mathematically proved that his decision to disclose or hold information is dependent on the effect of that decision on the price of the risky assets. The author, however, adds that the manager's decision is also affected by how traders will interpret his decision and that this leads to an equilibrium point of disclosure which is a point below which a manager's motivation to withhold information is consistent with the traders conjecture as to how to interpret that action.

Thus in a situation where information is withheld, investors have two option namely assume the worst for the firm and will price down the company stock or require an interest rate premium of the debt or alternatively seek and collect more information but this will only happen when they have time, money and the benefits of the information outweighs the costs. Diamond (1985) argues that individual collection of information is inefficient from societal perspective since scarce resources like time and money are being used by so many people to collect same information. This then means that a firm's voluntary disclosure of information is a more efficient way of meeting investor's information needs and this will lower the cost of its capital in the long term. Reliance on capital markets should incentivise a firm to voluntarily disclose and lower its cost of debt or equity but then as Verrecchia (1983) stated, existence of proprietary costs brings confusion to this logic.

The theory assumes that in the absence of proprietary costs, companies are motivated to disclose voluntarily as way of reducing information asymmetry or signalling their quality hence the availability of proprietary costs tend to bring noise in the equilibrium model. Verrecchia (1983) proved that the higher the proprietary costs, the less negatively affected investors react to withholding of information and that this leads to less voluntary disclosure by companies. The proprietary cost model also predicts fewer disclosures in a highly

competitive market noting that managers might be sensitive as to how competitors might use their own disclosures against them. Thus where release of good news might see investors reacting positively to the company stock, the same might open up competition from other potential entrant into the market who might be attracted to such good news. If the opponent enters, the firm incurs an exogenously specified proprietary cost that reduces firm value (Martin, 1999; Wagenhofer, 1990).

That voluntary disclosure has benefits and that disclosure of GHG information is sought after by many stakeholders is well documented by many researchers (Cormier and Gordon, 2001; Botosan, 1997). However disclosure of such information is among other factors hindered by related proprietary costs. To begin with the cost of preparing GHG information is costly in itself as it requires adequate investment in personnel skill and systems to collect the information. This is especially true considering that climate change and GHG emission information does not naturally fall within existing generally accepted accounting practices but rather require specialised specification. For instance Ratnatunga and Balachadran (2008) stated that the rising in prominence of climate change issues meant that companies have to consider redesigning their management information systems in order to accommodate the demands of this new phenomenon. Besides, credibility of their reports may only be enhanced with third party review which means more costs on the part of the company. Though not mandatory, many voluntary reporting initiatives encourage entities to have their reports audited by third parties. However even after meeting the preparation and dissemination costs, potential threats still remain with the manner in which competitors and other stakeholders use such information. Climate change is a highly sensitive and politicised issue which attracts high media coverage and lobbyists as such any information disclosed by a firm might potentially be used to its disadvantage. Being new area where firms are still trying to develop their own technologies and systems to deal with climate change, there is also a danger that too many disclosures might mean handing over hard earned innovative secrets to competitors on a silver platter. In fact Cormier and Gordon (2001) argued that environmental information is considered proprietary information as such holding or subsequent disclosure of the same could materially affect how stakeholders in particular investors value a firm. Therefore disclosure being a subject of perceived benefit over costs of such disclosures then the extent of disclosure of GHGs might be also explained within the context of proprietary theory.

The Proprietary Cost theory has not been widely used in many disclosure studies as

Healy and Palepu (2001) explained there is little empirical evidence of the proprietary cost hypothesis. Scot (1994) provided a direct investigation into effect of information cost on discretionary disclosure using financial statement announcement of defined benefit pension plan information. The author found support for proprietary cost theory and found that increases in proprietary cost positively correlate with less disclosure. Prencipe (2004) did another comprehensive test of the theory with regard to the determinants of segmental reporting in Italian companies and found the theory successfully predicted some factors that determine quality segmental reporting. Again, Cormier and Gordon (2001), examining the social and environmental reporting strategies of three utility companies in Canada found that compared to social disclosures, environmental disclosures were very sensitive to proprietary information costs. In this study such sensitivity to proprietary costs is also anticipated in as far as GHG information disclosures are concerned. Proprietary cost theory literature suggest ownership structure, market structure, company size, capital market risk can alter the reporting pattern of a firm.

2.8 Summary and Conclusion

Based on prior studies, an attempt has been made to explain the possible reasons behind voluntary disclosures. Since voluntary disclosures are deemed to be done without the influence of any regulation then there must be proper justification for a firm to dedicate resources in providing them. Among some of the reasons, it is believed that voluntary disclosures are made based on economic rationality meaning that a firm might engage in these disclosures as a means of gaining business opportunity rather than demonstrating a true sense of social responsibilities. On the contrast, others believe that conviction in accountability and responsibility might also motivate managers to disclose voluntarily. When managers have a belief that their stakeholders have inalienable right to be informed whatever it takes on the part of the firm then they will engage in voluntary disclosures. Others view voluntary disclosures as a means of gaining legitimacy while others view it as a mechanism of managing stakeholders' expectations. Again, the desire to forestall stringent regulations could also motivate firms to disclose voluntarily. Many have suspected that the increasing volumes of voluntary disclosure initiatives in climate change related issues by private sector, though meant to genuinely help firms manage their emissions, could be attempts to discourage regulations.

Most of the motivations are discussed within the context of various theoretical frameworks. The theories, while giving more insight into the motivations, also help explain why despite being motivated by same reasons, the quantity of disclosures differ from one firm to another. Under legitimacy theory, it is stated that a firm is continuously seeking to assure its society that it is operating in accordance with the acceptable norms. The ultimate aim is to achieve the right perception from stakeholders as such they tend to use disclosures to acquire the legitimate perceived image. Thus disclosing information like environmental information is seen as a means of sending a message to an entity's stakeholders that it is operating within the society norms. Unlike legitimacy which envisages a two party relationship between a firm and society, stakeholder theory analyses the relationship a firm have with many of its stakeholders which have different bargaining powers as such a firm is deemed to have different negotiated contracts with various stakeholders. While it is accepted that the primary objective of firms is to maximise shareholder return, there is also a wider societal belief that organisations are also expected to fulfil varying demands of its stakeholders which extends beyond the financial goal. A firm's failure to change course according to stakeholder demands might eventually lead to its extinction/or disappearance from the market. Therefore in an attempt to satisfy these contractual obligations firms use disclosures like GHG disclosures.

Agency theory which recognises the need for more information disclosure on the part of management so that the other party i.e. owners are kept informed of what is going on has also been discussed. The understanding is that management voluntary release of information may act as an attempt to demonstrate to other stakeholders particularly shareholders that they are performing optimally. Such disclosures are meant to minimise the agency problem that come with the separation of powers between management and owners. The other theory that deals with information symmetry problem between management and outsiders is the signalling theory. The core of theory is information asymmetry between company managers and investors. Thus managers in some way have information which investors do not have as such disclosure is seen as a signal on the part of those who know (managers) to those who don't know (investors) in an attempt to bridge the information asymmetry gap. Furthermore disclosure of information is seen as a signal of what management are capable of hence managers are motivated in voluntary disclosures as help demonstrate their know-how to the outsiders. Both aspects of signalling capability and the extent of a company's initiative in a certain aspect are considered relevant in the study of GHGs since it's a relatively new area

where government in the UK is critically looking at disclosures as way of making companies have initiatives to reduce emissions.

The cost of acquiring information and influencing the dynamics of the capital market has been discussed within the theory of proprietary costs. According this theory, disclosure of information is seen as an attempt on the part of the firm to lower the cost of acquiring information by its stakeholders notably investors. There is however need for a balance in between what is to be disclosed and the nature of information because certain information is strategic and hence cannot be easily disclosing for fear of competitors. Therefore proprietary costs, much as can influence a firm to disclose with a view of gaining cheap capital, they can also deter a firm from doing so depending on the nature of the information hence in this study the theory will be used to understand the variation in the disclosures made from firms more especially those in the same industry. This is important because under the institutional theory which has also been discussed here, disclosures are seen as a reflection of prevailing practice within an institutional set up. Institutionalism being a set of generally accepted norms prevailing within a particular setting which forces participants in that grouping to act in similar pattern. Therefore apart from differing influences of stakeholders, it is expected that proprietary costs, capital need and market structure can help explain the differences in disclosures of firms within the same industry/sector i.e. institutional set up.

The other theory discussed is stewardship theory which stemmed from Organisational psychology and sociology and is viewed as an alternative to agency theory. It helps to explain disclosures on the basis of rational behaviour displayed by managers suggesting that in the long run managers will act in the interest of the organisation. They will do this because they perceive that their self-interest can only be fulfilled when the organisation needs are met.

Going forward, the approach adopted in this thesis is a multi-theoretical approach. This is in line with a growing trend of literature in the social and environmental reporting research ((Ntim and Soobaroyen, 2013; Chen and Roberts, 2010). While the chapter has discussed the theories in isolation, it should be highlighted that most of the theories are overlapping. Gray et al (1995a) argued that of the social political theories, legitimacy and stakeholder theories should not be seen as totally distinct rather they complement one another and their application can be at different levels. Besides, prior evidence indicates that the notion of legitimacy cuts across different theories ranging from stakeholder, institutional theory and resource dependency theory (Pfeffer and Salancik 2003; Deegan, 2002; Gray et al 1996). The overarching assumptions in these theories is the fact that organisations are

influenced by their societies and in turn through their actions organisations can influence their societies or operating environment (Gray et al 1995a; Thomson, 1967). Chen and Roberts (2010; p.652) suggest that these theories share same *'ontological worldview in that they see reality/structures are continually created, reproduced and reoriented by the interactions among social organisations'*. Suchman (1995, p.576) state that legitimacy and institutionalisation are virtually synonymous. Suchman (1995) further argues that organisations, by adopting existing practices and structures through various institutional pressures, do so, on the pretext that the existing structures/practices have a form of legitimacy. Notwithstanding this, Chen and Roberts (2010) notes that though institutional theory can explain or describe existence of a legitimacy condition, it cannot explain the dynamic nature of legitimacy.

While legitimacy and institutional theories treat environment as a whole/one, stakeholder theory isolate and discuss a firm relationship with each of the environment constituent. Stakeholder theory recognises that groups have unequal power and influence over an organisation and that organisations should manage these stakeholders differently. Chen and Roberts (2010) argues that a firm gains legitimacy through satisfying expectations of different stakeholders who subjectively confer legitimacy on the organisation. This ties in with the notion 'relevant publics' as being an important constituent of stakeholders to be satisfied in order to gain legitimacy rather than the society as a whole (Lindblom, 1994). When organisation legitimacy is under threat, organisation can target those relevant publics affected with a view of manipulating or changing their perception on the organisation. In this case communication and interaction becomes important and that companies should engage in communication with a 'give and take' spirit. Freeman (1984) emphasises compromise in communication and Chen and Roberts (2010) noted that it is through the spirit of compromise that organisations engage in voluntary actions like social and environmental initiatives and reporting.

On the other hand, there is also overlap on capital market oriented theories. Thus both Agency and signalling theories are founded on the information asymmetry problem between two parties i.e. managers and capital market players (Morris, 1987). In this respect, managers are assumed to possess superior information than investors as such disclosure might narrow the asymmetry gap (Healy and Palepu 2001). In addition Healy and Palepu (2001) also argue that disclosure could be as a result of managerial intention to signal their talent with the hope that investors will incorporate that information in their valuation of the firm. In essence, firm

value is often seen as reflecting investors' perception of managerial ability for continued business viability. Notwithstanding the need to overcome information asymmetry or signal firm superiority/managerial talent, the Proprietary theory argues that any decision to disclose is based on the trade-off between cost and benefit of such disclosure (Verrecchia, 2001). Watts and Zimmerman (1986) explain that when engaging in voluntary disclosure, firms are concerned about the political and contracting costs that may follow the voluntary disclosure decision.

More importantly to environmental disclosure, Toms (2002) has argued for a link between signalling and stakeholder theory. He notes that since environmental management reporting may necessitate significant investment in systems and resources then for any attempt to signal the same should target on stakeholders who matter. Toms (2002) further argue that firms will require connection to resourceful stakeholders in order to invest in environmentally friendly systems.

Therefore based on the existing interdependences among the theories, this study will adopt a multi-theoretical approach in investigating the extent and determinants of the voluntary GHG disclosures. Besides, prior evidence suggests that no single theory can satisfactorily explain the rationale behind voluntary disclosure.

CHAPTER THREE

Empirical Literature Review

3.0 Introduction

Substantial evidence suggests that, for various reasons, companies have been increasing their corporate disclosures and that these disclosures have extended beyond the providers of capital (Doh and Guay 2006; Brammer et al 2012). This has been matched by increased volumes of voluntary disclosure related studies whose conclusions tend to point to one thing: Disclosure is a substantive issue worthy of more research (Spence and Gray 2007; Bartlett and Jones 1997; Beattie and Pratt, 2002). In this respect, many studies have investigated disclosure trends, causality between certain corporate governance, firm or industry characteristics and the disclosures while others have examined the theoretical basis of the motivations behind the various forms of disclosures. One particular aspect that has generated a considerable academic interest is corporate environmental disclosures. Just like in other disclosure studies, research in this area has mainly focussed on extent and nature of corporate environmental disclosure within annual/sustainability reports and its trend over time; its relationship to economic performance, environmental performance and corporate reputation; as well as the effect of certain corporate characteristics on the tendency to disclose environmentally relevant information (Aburaya, 2012).

Despite the growing academic interest in environmental disclosure studies, very few studies have examined specific aspects of environment like climate change and GHGs. Climate change and in particular GHGs is important in our time so much so that it is increasingly becoming a priority of targeted action both at national and international levels (see for example Kyoto Protocol 1997; UK Climate Change Act 2008 etc.). Of special interest is the role of companies in climate change which to a larger extent can be found in the GHG related information disclosures. Thus, stakeholders notably investors and regulators are keen to understand the role of companies in climate change as such there is growing evidence that they are demanding more GHG information (Stanny and Ely, 2008; Lash and Wellington, 2007).

Nonetheless, despite the realisation that the battle against climate change cannot be won without genuine and decisive action and accountability by the companies which are considered to be the main culprits (Solomon and Lewis, 2002), the policy move by most governments could at best be described as ‘cautious’, preferring firms to do things voluntarily

than issuing mandatory regulations. In the circumstances and in the broader context of environmental management, firms have been implementing their climate change and GHG emissions strategies and have been communicating the same through various mediums such as annual reports, sustainability reports and websites. However considering the voluntary nature of prevailing regimes coupled with the uncertainty surrounding the cost and benefits of engaging in such voluntary initiatives, questions still remain as to what determines the extent of these corporate voluntary GHG disclosures and indeed, what roles do existing decision-making structures such as board mechanisms play in the disclosure decisions (Galbreath, 2010; Peters and Romi, 2012; Rodrigue et al., 2013). This is especially germane given the potentially litigious nature of the disclosed GHG emissions information (Wegener et al., 2013; Prado-Lorenzo and Garcia-Sanchez, 2010).

Therefore the aim of this chapter is to review the available literature on the determinants of the disclosures in particular those on environmental and GHG disclosures so as to identify existing gaps in literature.

The chapter begins by discussing selected corporate governance, ownership structure, and company attributes that determines the disclosures and in the second part it details some qualitative studies undertaken particularly focussing in GHGs or environment. The final section discusses the limitations of the GHG and other disclosure literature and explores the gaps which can be filled by the present study. A chapter summary is thereafter presented.

3.1 Determinants of GHG Disclosures: Review of Literature

3.1.1 Corporate Governance Characteristics

Agency theory underpins most of the studies investigating the role of corporate governance mechanisms on voluntary disclosures. Agency theory conceptualised by Jensen and Meckling (1976) provides a basis or justification on which governance mechanisms are put in place to resolve conflict of interest or incentive problems brought by the modern form of corporation in which ownership is diversified from management (Donnelly and Mulcahy, 2008). Separation of ownership and control often leads to information asymmetries which if not checked are exploited by managers for their own benefit at the expense of the shareholders (Jensen and Meckling, 1976). Thus corporate governance mechanisms serve as guardians of shareholder interests amidst competing interests by various stakeholders of the firm (Kumar

and Zattoni, 2013). Since at the heart of the agency relationship between managers and owners is an issue of information asymmetry, prior literature has documented evidence that corporate governance mechanisms help improve corporate disclosure as a way of minimising the information asymmetry gap (Chen and Jaggi, 2000; Peasnell et al., 2005; Rankin et al., 2011; Mangena and Tauringana, 2007). Therefore, in theory, corporate governance mechanisms should assist in aligning managers' interests to those of the institution and so reduce agency costs in the long term.

The literature has identified a number of corporate governance characteristics that help influence voluntary disclosures. These include board composition and size, the presence of non-executive directors, CEO duality, audit committee and audit firm. Beasly et al. (2000) found the presence of non-executive directors on the board to be crucial in preventing management fraud thereby protecting shareholder interests. The board of directors are also meant to champion transparency and accountability which is essential in disclosures (Collier and Zaman, 2005). Studies on GHG disclosures particularly focusing on corporate governance characteristics have included Prado-Lorenzo and Garcia-Sanchez (2010) who investigated the role of board of directors in divulging relevant GHG information in a sample of FTSE Global 500 companies which participating in the CDP 2008 survey. The disclosure index was developed from the Carbon Disclosure Leadership Index (CDLI). Their results partly indicated that though firms are under public pressure to disclose GHG information, the board of directors sometimes discourages these disclosures if there is high probability of litigation i.e. more especially when the costs of disclosure outweighs the benefits. Their results also suggested that while the business environment has changed over time with the influence of other stakeholders increasing, as far as climate change related information is concerned, the board has continued to maintain the tradition of prioritising shareholder interests.

In another study focusing on which attributes of corporate governance influences a firm to make GHG disclosures, Peters and Romi (2012) examined the determinants of GHG voluntary reporting in a sample of firms participating in the CDP from 2002-2006 and found evidence that GHG disclosures were positively related to what they called 'sustainability oriented corporate governance characteristics notably the presence of environmental committee on board as well as the position of corporate sustainability officers. Expertise and size of the board members and sustainability officers were dominant characteristics of those firms that disclosed more GHG information. Knowledge synergies between environmental

committee and the audit committee were also found to be a significant element in increasing the likelihood of voluntary GHG disclosures. Galbrealth (2010) investigated how well governance structures by both US and non-US firms had enabled the firms to respond to climate change challenge using 98 firms in three industries across ten countries. Overall they found that the firms were underperforming in their governance responses towards climate change but noted that non-US firms had a better governance score than their US counterparts using the Ceres scoring methodology. In addition, board characteristics such as board size, and diversity (including female representation) had no statistical link to climate change disclosures, while directors' age had some influence with younger directors exerting positive influence.

Below is a summary of how board characteristics adopted in this thesis have influenced other voluntary disclosures as per prior literature. The list is largely drawn based on sample characteristics and prior literature. For instance some characteristics like CEO duality and sustainability officers were left out because of insufficient observations. In particular it was observed that very few observations had instituted a specific department or full time employee responsible for sustainability and this was largely in years 2010 and 2011.

3.1.1.1 Board Size

Large sized board which reflect various stakeholder interests may in a way help reduce information asymmetry (Chen and Jaggi, 2000). The main function of the board is to formulate policies and strategies to be implemented by management. In discharging their role, the board is aware that information is an important link to its outsiders as such it may champion policies that encourage more disclosures. The large numbers on the board is likely to make the board function effectively in ensuring that policies and strategies are being implemented (Zahra et al., 2000). A large board is also likely to have diverse experience and skills that may be crucial in assisting management in the processing and disclosing useful information (Akhtarudin et al., 2009).

Nonetheless, others argue that large boards can be dysfunctional. Jensen (1993) argued that big-sized boards are synonymous with poor monitoring performance whereas small sized boards are efficient and might influence more disclosures of information. Thus in a large sized board, there are bound to be conflicts of interests of the various groups represented which in a way might hinder the monitoring process of the board. Coordination may also be a problem which can then lead to slow decision making thereby affecting the

efficiency of the board (Yermark, 1996). Despite this, it is intimated that the inefficiencies may only occur in circumstances where the board is excessively large (see Aburaya, 2012) and that even if the board is large indeed its inefficiencies maybe offset by the diversity and skills of the board members which if put to good use can improve monitoring abilities of the board (John and Senbet, 1998). A larger board may also result in well constituted sub-committees which may improve the functionality of the board.

Empirical studies have found evidence of the influence of large sized board to disclosures. Peters and Romi (2012) noted that in addition to other board attributes, those firms with a large board size had more GHG disclosures. Similarly, Cormier et al. (2011) found a positive association of large board size and disclosures. The study by Cormier et al. (2011) investigated whether environmental disclosures substitutes or compliments efforts in reducing information asymmetry between corporate managers and stock market analysts on a sample of 137 large Canadian companies listed on Toronto Stock Exchange in 2005. Their environmental disclosure score was weighted with a high score awarded if disclosures are quantitative and specific than qualitative and general. The results among other factors, found that board size was the only board characteristic that had a significant positive relationship with environmental disclosures. Other studies such as Michelon and Parbonetti (2012) did not find any association but their sustainability disclosure index was broadly constructed as it also included social disclosures. With regard to specific GHG disclosures, the only known study to have investigated the role of board size is Peters and Romi (2012).

3.1.1.2 Proportion of Non-Executive Directors (PNED)

Generally, the presence of independent NEDs and the separation of roles between CEO and board chairperson are used as indication of board independence (Prado-Lorenzo and Sanchez, 2010). Considerably, the presence of non-executive directors helps the board discharge its monitoring responsibilities effectively (Fama and Jensen, 1983; Akhtarudin et al., 2009). In fact, according to the Combined Code (2012), Companies in the UK are encouraged to have more non-executive directors than executive directors on their boards as a way of improving board efficiency. It is intimated that board members with no material interest in the company are able to act both in the interest of shareholders and other legitimate stakeholders of the company. Thus from a stakeholder theory perspective, independent non-executive directors which represents the interest of other stakeholders other than management are viewed as a tool for monitoring management behaviour (Dixon et al., 2005). Such monitoring, from the

perspective of agency theory, helps to minimise the principal-agency problem that exists between shareholders and management.

Nevertheless, there is no study on GHG disclosures which has investigated the influence of non-executive directors and those that have focussed on environmental disclosures have documented limited and conflicting outcomes. Post et al.'s (2011) study investigated the influence of board characteristics on environmental social responsibility disclosures in a sample of 78 fortune 1000 companies listed in 2007. Disclosures made in annual reports, environmental reports, company websites and government websites were reviewed and in relation to board independence, the authors found that companies with high proportion of outside directors on their boards had higher environmental and social disclosures. Brammer and Pavelin (2006) studying the determinants of environmental information in the UK did not confirm any significant relationship.

In other voluntary studies other than social and environmental disclosures, the results are also inconclusive. A study by Elzahar and Hussainey (2012) used ordinary least squares regression to measure the impact of firm specific characteristics and corporate governance mechanisms on the disclosure of risk information in the interim reports of 79 UK companies. Board composition (represented by ratio of NEDs) alongside institutional ownership, role duality, board size, and audit committee size had no statistical significance on the corporate risk disclosures. Similarly, Ho and Wong (2001) did not find any association between voluntary disclosures and the presence of NEDs. However, Akhtarudin et al.'s (2009) study of corporate governance influence of disclosures on Malaysian firms found evidence that more NEDs meant more disclosures. Chen and Jaggi (2000) had a similar result to that of Akhtarudin et al. (2009). On the contrary, Eng and Mak (2003) found a negative relationship between independent NEDs and voluntary disclosures, and explained that the result was a reflection of the fact that many of NEDs on the board of companies in Singapore represented the interests of block holders which in many cases have privy information of the company hence might not be keen on public disclosures.

3.1.1.3 Audit Committee

The presence and the composition of an audit committee on the board are deemed fundamental to the oversight roles of the board. Good corporate governance practice requires companies to ensure that the audit committee is chaired by an independent qualified NED and its composition should have more NEDs than executive directors (Solomon, 2010). The

combined code (2012) recommends that the AC should involve at least three, or in the case of smaller companies two, independent non-executive directors. With such characteristics, the audit committee is expected to champion policies that improves transparency in the company and hence considered to have a positive influence on the quantity of the disclosures (Forker, 1992). Thus, independence of the audit committee helps it to carry out its monitoring responsibilities objectively (Abbot et al., 2004). One key responsibility of the audit committee is to have oversight over the financial reporting process of the company (Uzan et al., 2004) which then makes it well placed to influence disclosures.

The audit committee is tested in terms of its size compared to the whole board or its independence (Akhtarudin et al. 2009). Aburaya (2012) studied the influence of corporate governance characteristics on environmental disclosures of a sample of UK FTSE All share companies over a four year period i.e. 2004-2007 and found evidence that the independence of an audit committee is positively related to environmental disclosures. Similarly, some studies on other voluntary disclosures have confirmed the positive association between audit committee and voluntary disclosures (Barako et al., 2006) while others like Akhtarudin et al. (2009) did not find any association. Studies on GHG voluntary disclosures have not focused on audit committee but instead the focus has been on the existence of other specialised board committees like environmental committee.

3.1.1.4 Board Environmental Committee

The presence of the environmental committee on the board signifies the seriousness with which the board attaches to issues of the environment and climate change in general (Rankin et al., 2011). It also demonstrates a firm's desire to manage its reputation risk (Nue et al., 1998). An environmental committee of the board could also reflect the strategic direction of the firm in repositioning itself for a carbon constrained future since the board by its nature is a custodian of long term strategy. Since climate change and GHG issues are highly sensitive then a firm might be using the presence of the environmental committee to champion measures that might reduce the potential risks of regulation by managing its stakeholders through disclosures.

The phenomenon of environmental committees is relatively new but prior studies have found evidence that the creation of specific board committees like corporate social responsibility committee or human resource committee leads to increased disclosure in those particular aspects (Berthelot and Robert 2012; Cowen et al., 1987). More importantly, Peters

and Romi (2012) studying the influence of corporate governance on GHG disclosures argued that just as the presence of audit committee influences financial disclosures, the presence of environmental committee is also crucial to disclosure of GHG information. The authors noted that the fact that environmental committee is not mandatory as is the audit committee then its presence indicates the seriousness of management in controlling GHG emissions and communicating its efforts to relevant parties. In addition, Ewing (2008) argues that the key to managing climate risk lies in defining the roles of the board appropriately and creation of an environmental committee could be one of those efforts. Peters and Romi (2012) confirmed that the presence of an environmental committee on firms participating in CDP disclosures between 2002 and 2006 had positive influence on the disclosures. Their analysis went further and confirmed that size and diligence of the environmental committee coupled with the expertise of the sustainability officer were positively related to voluntary GHG disclosures. More importantly the authors also found that knowledge spill over from overlap between the environmental committee and the audit committee significantly increased the likelihood of a firm to disclose GHG information. The findings of Berthelot and Robert (2012) also lend support to the fact that it is not only the mere presence of the environmental committee that determines the GHG disclosures but the characteristics of the committee also matters. Thus Berthelot and Robert (2012) found that the presence of an environmental committee influences the disclosures but a critical review of this factor indicated that it was actually the number of committee members and the proportion of independent directors on this committee rather than the number of meetings that influenced GHG disclosures.

Nonetheless, Rankin et al. (2011) did not find any evidence that an environmental sub-committee of the board would influence GHG disclosures. Instead what they found was that firms with an environmental management system like those certified by ISO 14001 EMS was disclosing more GHG information and that the presence of an environmental committee merely improved the quality of the disclosures. The authors' definition of quality included provision of an explanation behind the disclosures made.

3.1.2 Ownership Structure

Different forms of ownership structure have been studied in literature ranging from ownership concentration, managerial ownership, government ownership, foreign ownership, family ownership to institutional ownership. In this study, two forms namely ownership concentration and managerial ownership are discussed.

3.1.2.1 Ownership Concentration

When there is a wider diffusion of ownership, agency costs increase (Fama and Jensen, 1983). This is the case since with wide diffusion of ownership; there is a rise in conflict of interests as opposed to when a firm has concentrated ownership. Shareholders are a key resource stakeholder to a firm and have power to influence how resources are managed. In a widely diffused ownership, shareholders are likely to find it expensive to mobilise themselves to exercise their power compared to more concentrated ownership structure. The high number of shareholders in highly diffused structure means more costs for the company when trying to bring shareholders together for a particular resolution. The other argument is that with a wide diffused ownership, the demands of shareholders are diverse as such a firm is forced to make more disclosures to satisfy these demands (Mitchell et al., 1995; Reverte, 2008). In mitigating against the high agency costs, meet the varied demands of the shareholders and signal to shareholders that they are acting in the interest of the company; managers can use a number of strategies including voluntary disclosures (Broberg et al., 2009; Christopher and Hassan 1996). Berthelot and Robert (2012) studying the determinants of GHG disclosures in Canadian Oil companies found that a widely held ownership structure in a firm was positively correlated to disclosures. Prior studies like Hill and Jones (1992) also found that a widely diffused ownership is associated with more voluntary disclosures.

Others argue to the contrary that it is in a more concentrated ownership where a firm would make more disclosures. This view considers disclosures more of a product of shareholder power than otherwise. Thus, while noting that shareholders in a concentrated ownership are bound to use their power in concealing any information they deem detrimental to the company (see Cormier and Magan 1999), Zunker (2011) argued that such power can also be used to influence increased disclosures. There is however little support for this view in literature. In a study of 2008 annual reports of 96 largest Australian firms listed on Australian Stock Exchange (ASX), Rao et al. (2012) investigated the relationship between environmental reporting and corporate governance attributes. Institutional investors (which represented close ownership concentration) had a small but positive impact on the environmental disclosures. The authors conjectured that this could be a reflection of the fact that institutional investors being active participants in capital markets where the risk of environment on stock value is appreciated might encourage more disclosures. Alternatively it could suggest that in closely owned firms, it is difficult to find an appropriate proxy for

control exercised in decision making regarding disclosures within firms. Despite this, however, it is reasoned that in a closely owned firm, there is less pressure to release information since shareholders are already aware of what management is doing (Berthelot and Robert, 2012). This view is also supported by the results of Brammer and Pavelin (2006) who, in a study of determinants of environmental disclosures in the UK, found a significant negative relationship between ownership concentration and environmental disclosures.

3.1.2.2 Director Ownership

According to agency theory, misalignment of management/shareholder interests leads to high agency costs. Increased management shareholding reduces the prospect of the interests' misalignment thereby reducing the agency costs (Jensen and Meckling, 1976). Jensen (1993) argues that the source of most problems in a company arise due to the fact that neither the manager nor non-shareholding directors have an interest in the company. It is the intention of reducing agency costs that makes management involve in disclosures hence where there is a greater extent of managerial ownership disclosures might be kept to a minimum. This is also backed by signalling theory which helps to predict that in a situation where there is separation between ownership and management, managers are bound to disclose more to signal to the other party that they are acting in good faith. This desire for signalling may be reduced in a situation where management has substantial ownership. In addition, increased management control might also tempt management to limit disclosures as way of managing and manipulating other minority shareholders and competition. It is also argued that managerial shareholding guarantees managers long term employment prospects as such they do not have incentives to pursue shareholder wealth maximisation policies since labour market forces have no power over them.

Fan and Wong (2002) explains that control enables the controlling party to decides and choose reporting policies which leads to restrictions on other reporting parameters if the intention is to manipulate other parties. This is in contrast to where management has no stake or have a low stake. In this case, it is argued that since management are aware of not being individually responsible for the costs of disclosure, they are motivated to make more disclosures which might be used to enhance their reputation and prestige in the eyes of the public (Halme and Huse 1997).

Eng and Mark (2003) using regression analysis of 158 companies drawn from 9 different industries, observed that lower managerial ownership of companies listed on

Singapore Stock Exchange had significantly influenced higher disclosures. When managers reduce shareholding, it is argued that they become more interested in remuneration but have little incentive for job performance as such there is increased monitoring by outside shareholders. Increased monitoring increases costs as such managers might disclose more information to reduce these costs (Eng and Mark, 2003). Nonetheless others have found evidence to the contrary. Warfield et al. (1995) documented a positive relationship between managerial shareholding and the level of earnings disclosure. In this study, the authors reported that the earnings-return correlation is greater for firms with high levels of managerial ownership, and interpreted this result as evidence that accounting disclosures information content increases with the level of managerial ownership. Perhaps the most interesting result is one documented by Leung and Horwitz (2004) who, using Hong Kong listed companies, found that an increase in director ownership of between 1 and 25 was positively associated with increased segmental disclosures but a disclosure decrease was noticed for any levels of director ownership above 25 per cent.

3.1.3 Company Characteristics

3.1.3.1 Size

Company size has been widely used and found to have a positive relationship with the extent of corporate GHG disclosures (see Freedman and Jaggi, 2005; Prado-Lorenzo et al., 2009; Stanny and Ely, 2008 Rankin et al., 2011 etc.) and other disclosure studies (see Firth, 1979; Cooke, 1989; Gray et al., 1995; Meek et al., 1995; Nue et al., 1998; Tauringana, 1997; Wallace et al., 1994;). Such usage is a reflection of the fact that size represents a wide range of things from political visibility (which means political costs as well as increased scrutiny by stakeholders), agency costs, to capital market incentives (Lang and Lundholm, 1993; Cormier et al., 2005).

According to agency theory, there is an information asymmetry problem that comes with the principal-agent relationship. Such a problem leads to increased agency costs depending on the nature of management and ownership relationship. In agency theory, it is suggested that agency costs increase with increased share of external capital (see Jensen and Meckling, 1976) and this share of capital is deemed high when a company is of a large size (Leftwich et al., 1981). Disclosure of information is considered part of reducing the problem and related agency costs (Adrem, 1999). Besides, by virtue of its attraction to various sources

of external capital, it is expected that a large firm will be under pressure from a number of its stakeholders especially financial analysts to disclose more information to cater for those stakeholders that might be remotely aware of what is going on in the firm (Depoers, 2000; Lang and Lundholm, 1993). In this case, disclosure may serve to enhance investor trust (Buzby, 1975).

Generally apart from attractiveness to providers of capital, large companies are believed to have high visibility to the extent of attracting huge political costs. By nature, it is argued that the media and the public are interested in large companies as such in keeping pace with what the company is doing they will demand more information of which the company will comply through the disclosures (Schipper, 1991; Lang and Lundholm, 1993). Apart from these stakeholders, large size companies may also attract government agencies. Such attraction may mean more political costs if intervention steps are taken as such firms may resort to disclosing more information hoping that transparency and accountability may limit the level of intervention (Buzby, 1975; Holthausen and Leftwich, 1983; Watts and Zimmerman, 1978; Scott, 2003; Gray et al., 1995a).

While firms may be inclined to disclose more information with the view to improving their capital market fortune, there is a realisation that disclosure of information is expensive and requires right skilled employees (Depoers, 2000). Even if a firm decides to meet the costs of disclosure, there is threat that such costs may adversely affect its competiveness (see Raffounier, 1995), and in some cases the disclosures themselves may pose a strategic threat to a firm if competitors access such information. Given these circumstances it is believed that a large firm is better placed to meet the costs of disclosures (see Depoers, 2000) and mitigates any threat of losing competitiveness than a small firm (Watson et al., 2002; Prencipe, 2004).

There are a number of studies investigating GHG or climate change disclosures that have used size as a control variable with the outcomes confirming size as a significant factor. For instance, Freedman and Jaggi (2005) analysed the disclosure of GHG emissions in annual reports, separate environmental reports and websites of 120 entities in Chemical, Oil, Motor Vehicle, and Insurance industries. The companies were selected from both countries participating in Kyoto Protocol and those not participating in order to investigate the impact of the Kyoto on the company disclosures. Using regression analysis, they documented a positive association between the disclosure index and those entities operating in countries that ratified the Kyoto Protocol and again size (measured by natural log of total assets) was reported to be one significant determinant of GHG information in these entities. Another

study by Prado-Lorenzo et al. (2009), who using multiple regression of data obtained from content analysis of company website information, noted a positive relationship between size (sales turnover), market capitalisation and quantity of information on GHGs. They developed their disclosure index from EC Green paper on GHG emissions Trading, Kyoto protocol specifications and some indicators as specified by GRI (2002) standards. However the use of GRI index for a disclosure check list has come under criticism by other researchers (see Rankin, 2011) who argue that GRI (2002) is just a broader sustainability index and is narrow on GHG disclosures. Day and Woodward (2009) also made a similar observation regarding GRI calling it 'a generic' document that does not address a specific sector.

Some studies have utilised the CDP questionnaire responses to investigate among other things the influence of size on GHG disclosures. Peters and Romi (2010) conducted a longitudinal study covering years 2002 to 2006 for 28 countries and focussing on country specific influences on GHG disclosures. Size used as a control variable was found to be a significant determinant of the GHG disclosures. Their findings also revealed that the level of disclosure is related to the environmental regulatory stringency of the government, the private sector environmental responsiveness, as well as the capital market structure of each country. Similarly, Stanny and Ely (2008) reviewed the influence of environmental disclosures about the effects of climate change in a sample of US S&P 500. Factors investigated included company size, industry, capital expenditure, previous disclosures, foreign sales, asset age, Tobin's Q, leverage, profitability and institutional ownership. The main focus of the study was on whether a company responded to the CDP questionnaire or not. Using binary logit regressions the results confirmed that company size, previous disclosures, and foreign sales were significant determinants of the disclosures. No significant association was found with regard to profitability, institutional ownership, leverage, industry, asset age, and Tobin's Q.

The use of CDP information has however, come under criticism as to their reliability in that firms tend not to disclose their specific climate change related information (Kolk et al., 2008). The lack of specific GHG information in CDP questionnaire responses was also noted by Stanny (2011) who examined voluntary disclosures of GHGs by 500 US S&P participating in the CDP over a three year period i.e. 2006-2008. The focus was on documenting trends in questionnaire responses, actual emission disclosures and the accounting methodology used. She noted that many firms were responding to the questionnaire but were not disclosing their methodology or emissions. She referred to this disparity as being explained by legitimacy noting that firms responses were merely a means

of gaining legitimacy through participation in the project while in essence were not doing according to the spirit of the project as evidenced by their failure to disclose actual emissions and methodology used. She also established that previous disclosures were highly predictive of subsequent disclosures. This is consistent with the views that environmental disclosures are routine (see Cormier et al., 2005) and the findings of Aerts et al. (2006) who found that previous disclosures were highly predictive of the subsequent ones. By disclosing the minimum, Stanny (2011) suggested that it is an attempt to avoid setting a disclosure precedent as found by Graham et al. (2005) whose survey documented evidence that Finance Directors were bound to disclose the minimum possible in a bid to avoid setting disclosure precedent that may be difficult to maintain. In contrast to prior studies that used CDP data before, Stanny (2011) did not use content analysis instead the dependent variable was interpreted through the three disclosures namely response to CDP questionnaire; GHG emissions disclosed and the disclosure of the accounting methodology used. In addition, the earlier period of CDP questionnaires i.e. 2003 to 2005 covered by the samples are characterised by changes in questions from year to year. Such changes also mean that it is difficult to document trends of disclosures even for a single company (Hesse, 2006; Kiernan, 2008). This then means that studies based on CDP questionnaire response are not complete in themselves to explain the motivation and determinants for disclosures.

Other studies focussing on GHG disclosures which have confirmed the positive significance of size on the disclosures include: Liu and Anbumozhi (2009); Freedman and Jaggi (2005); (proxied by sales turnover); Prado-Lorenzo and Garcia-Sanchez (2010); Rankin et al. (2011) (natural log of market capitalisation); Berthelot and Robert (2012) (total assets). Generally in disclosure literature, majority of the studies tend to confirm the positive relationship between disclosure and size as predicted by the theories (see Adams et al., 1998; Gray et al., 1995b; Hussein, 1996; Walden and Stagliano, 2004; Clarkson et al., 2008; Patten and Crampton, 2004 etc.). Nonetheless there are other studies which did not confirm this positive relationship instead they found a negative relationship (Gray et al., 1995a; Roberts, 1992; Kou and Hussein, 2007).

3.1.3.2 Gearing

Gearing as signified by the presence of debt holders in a company is explained principally by three theories namely agency, signalling and stakeholder (Broberg et al., 2009; Roberts, 1992; Oliviera et al., 2006). Under agency theory, the principle is that a high debt ratio

increases agency costs as debt suppliers strive to secure their interests through various agreements and contracts (Jensen and Meckling, 1976). It is through these contracts that restrictions on what management can do to affect wealth transfers between shareholders and bondholders are prescribed (Belkaoui and Karpik, 1989). By providing more information, the uncertainty on the part of creditors is minimised thereby reducing the agency costs (Watson et al., 2002; Hossain et al., 1995). Agency theory therefore suggests a positive association between disclosures and leverage (see Broberg et al., 2009).

Others consider the influence of creditors from a stakeholder point of view. Creditors are deemed key to a firm's financing resources therefore they deserve to be managed appropriately. If creditors perceive they are marginalised within the affairs of the firm they can exercise their economic power by either increasing the cost of capital or by withholding debt financing altogether (Mitchell et al., 1995). Since evidence states that disclosures sometimes reflect stakeholder power (Roberts, 1992) then it is suggested that high proportion of debt is likely to result in more disclosures.

Alternatively, using signalling theory, other researchers have argued that disclosures in low geared firm are likely to be more and a signal to the market about its capital structure (Oliviera et al. 2006;). Some like Adrem (1999) have argued that even using agency theory, the presence of agency costs in free cash flow should imply a negative relationship between disclosures and leverage. Others simply argue that by being highly geared it means a firm is subject to various stakeholder controls and monitoring which then means that it cannot have incentive to disclose even more for fear of escalating costs (Jensen, 1986). Meek et al. (1995) provides empirical evidence to the effect that a low geared company is likely to disclose more information.

Despite the predictions as made by both stakeholder and agency theories, empirical studies have produced mixed results. In fact the majority of studies on GHG disclosures have found gearing to be insignificant. Rankin et al. (2011), in a study of voluntary GHG disclosures in Australia hypothesised a positive association but their results found gearing to be insignificant. The same result was found with Cotter and Najar (2011) who investigated institutional investor influence on climate change disclosures and noted that highly geared companies participating in the CDP were not disclosing more information. Gearing was only significant when those firms which did not complete the CDP were included in the sample thereby arguably suggesting that highly geared companies not participating in CDP provided more information hence they see no need of being part of CDP. Freedman and Jaggi (2005)

argued that creditors in a highly geared company that emit GHGs are bound to demand more disclosures to help them assess the risk of the company effectively. Despite this, however, their results did not confirm the assertion leading them to conclude that in climate change disclosures, creditors does not play a crucial role in influencing disclosure decisions. The Study of Prado-Lorenzo et al. (2009) concluded that gearing was insignificant and had negative relationship with GHG disclosures. This is similar to the findings of Brammer and Pavelin (2006) who, investigating environmental disclosures in the UK, found a negative association between disclosures and gearing.

Luo and Tang (2011) is an exception in that they found that GHG disclosures had a significant positive relationship with gearing. They examined the effectiveness of the CDP code and the determinants of the transparency of the carbon disclosure. Using a sample of the Global 500 firms the authors assessed the degree of transparency of carbon disclosures through a Carbon Disclosure Leadership Index which they renamed it carbon disclosure transparency score (CDTS) extracted from the CDP presented in 2009. Particular emphasis was placed on the influence of information needs of stakeholders and institutional effects on carbon transparency. The authors also found that, among other things, gearing was significantly associated with transparency in the carbon disclosures. Besides, while their findings confirmed that a growing number of firms were disclosing carbon information, they discovered disparities in the transparency of the information among firms in different sectors and industries. This lack of transparency was attributed to lack of incentives on the part of management to be accountable. Compared to other studies on GHG disclosures, here the focus was on what is disclosed than merely disclosures.

Results in studies on disclosures other than GHG disclosures have similar pattern of mixed outcomes. Some who found no association include Abraham et al. (2007); Oliviera et al. (2006); Linsley and Shrives (2006); Wallace and Naser (1995); Meek et al. (1995) while other studies have that a highly geared company discloses more information (see Malone et al., 1993; Naser et al., 2002; Hossain et al., 1994; Jaggi and Lee, 2002).

3.1.3.3 Profitability

Based on theoretical frameworks of agency, signalling and positive accounting, a positive association is assumed between disclosures and profitability (Ismail and Chandler, 2005; Broberg et al., 2009). According to agency theory, when a firm is profitable, management are bound to disclose more information as a way of justifying their positions and compensations

(Oliviera et al., 2006). Driven by the desire to be accurately valued by outsiders/investors, highly profitable firms are expected to disclose more information as a way of signalling the superiority of their firm over rivals and avoid undervaluation (Lang and Lundholm, 1993). Being profitable relative to industry peers also means that a firm is politically visible (with potential for more political costs) then a firm might use the disclosures to demonstrate how it has generated the profits in a bid to have goodwill of the stakeholders whose suspicion and intervention might potentially increase the political costs (Oliviera et al., 2006). Besides, with respect to disclosure costs, it is expected that a profitable firm will be able to meet these costs and disclose more than a less profitable firm would do (Verrecchia, 1983; Dye, 1986). The measures of profitability used in literature include return on equity (ROA), return on assets (ROA), (See Prado-Lorenzo et al., 2009; Freedman and Jaggi, 2005).

Empirical studies testing the association between profitability and disclosures have produced mixed results. In particular, the influence of profitability to environmental and GHG disclosures is somewhat inconclusive. Clarkson et al. (2008) stated that profitability had no influence in the environmental disclosures of American companies. Freedman and Jaggi (2005) found no significant influence of profitability in their study of environmental and climate change disclosures either. The same was with Prado-Lorenzo et al. (2009) whose study exclusively reviewed the determinants of GHG disclosures. Other GHG disclosure that found an insignificant relationship include Liu and Anbomuzhi (2009); Peters and Romi (2012); Rankin et al. (2011); and Cotter and Najar (2011).

However the results found by Liu and Anbomuzhi (2009) were different and interesting. Liu and Anbomuzhi (2009) investigated the determining factors of environmental information by Chinese listed companies based on the stakeholder theory. Factors investigated include shareholder power, government power, creditor power, while controlling for firm size, return on equity, age, location and learning capacity. Regarding profitability, they found that economic performance had no significant association with environmental disclosures but noted that companies with better economic performance (measured by ROE) were making more disclosures on specific environmental information particularly environmental investment and pollution control information. The dependent variable was derived from a combination of GRI indicators and China State Environmental Protection Administration (SEPA) guidelines and regression analysis was performed on the final sample of 175 companies. The study also found that government power rather than shareholder power and creditor power was significant determinant of environmental disclosures.

Other studies found a different result. Berthelot and Robert (2012) examined the extent to which Canadian oil and gas firms were following the Canadian Institute of Chartered Accountant proposed guidelines on climate change disclosures in their annual reports, and whether the disclosures of these firms were influenced by their media visibility, the presence and operating characteristics of an environmental committee within the board of directors, their ownership structure, their audit firms, their political exposure(size), profitability and media visibility. Using regression analysis on a sample of 64 Canadian public oil and gas firms with production activities, they found that profitability (economic performance indicator) represented by ROA, widely held ownership, political exposure and media visibility had a positive significant relationship with the GHG disclosures. It should be noted however that the study of Berthelot and Robert (2012) particularly focused on GHG disclosures made in annual reports. Most of the GHG disclosure studies that have found profitability to have an insignificant relationship with GHG disclosures have analysed disclosures made in multiple communication mediums including websites, sustainability reports and the CDP.

3.1.3.4 Liquidity

The influence of liquidity on disclosures is seen mostly from the stakeholders' theory perspective. Ho and Taylor (2007) argued that the long term prospect of a firm is dependent on how its stakeholders evaluate its going concern. They state that liquidity considerations are high when stakeholders are deciding the going concern prospect of a firm. Therefore in order to be viewed positively, it is expected that a highly liquid company will undertake to disclose more information as a way of setting itself apart from its peers who might be having liquidity problems. Such motivation for disclosures is also explained by signalling theory. On the other hand, it has been argued from the stakeholder point of view that, a firm with low liquidity, under the influence of key stakeholders like government agencies who are concerned with business viability of low liquid companies, might be indirectly forced to disclose more information to demonstrate its viability (Al-Shammari, 2007). Ratio of current assets to current liabilities is used to measure liquidity.

Empirical studies produce mixed results relating to the influence of liquidity on disclosures. In a study of Triple Bottom line (TBL) disclosures, Ho and Taylor (2007) hypothesised a positive association between the TBL disclosures and liquidity in their study of 50 largest US and Japanese firms but instead their results was a negative but significant

relationship meaning that highly liquid firms tend to disclose low TBL information. However when Liquidity was tested specifically against environmental disclosures within the TBL disclosures, the relationship was negative and insignificant. In other voluntary disclosures, Barako et al. (2006) investigated the extent to which ownership structure, corporate governance and company characteristics influences voluntary disclosures including environmental disclosures. The sample comprised 54 Kenyan companies listed on Nairobi Stock Exchange from 1992 to 2001. Liquidity (measured as current assets divided by current liabilities) alongside profitability, board leadership structure, and type of external auditor did not have any significant influence on the voluntary disclosures.

A different outcome was obtained by Oyelere et al (2003). Using univariate and multivariate regression analysis, the authors examined the determinants of internet reporting in all 229 companies listed on New Zealand Stock Exchange at the end of 1998 and found that among other factors, liquidity (measured as cash assets divided by total assets) was a significant positive factor in internet reporting in New Zealand. The differences in the computation of liquidity in the study of Oyelere et al. (2003) to other studies like Barako et al. (2006) could partly explain the difference in the outcome.

So far the studies on climate change and GHG disclosures have not investigated the influence of liquidity. With climate change issues threatening the resource flow to and from a firm then there is still a case to investigate how liquidity position of a firm can influence its response to climate change which is reflected in the disclosures.

3.1.3.5 Industry Sector

The influence of industry on disclosures is justified in a number of theories namely positive accounting (political costs) theory, proprietary costs theory, legitimacy theory, signalling theory, agency theory and institutional theory.

According to political cost theory, industry belonging just like size makes it easy for a company to have political visibility and vulnerability (Watts and Zimmerman, 1986). Faced with the same political costs, companies in the same industry might resort to voluntary disclosures as a way of minimising these costs. With the agency theory, it is intimated that companies whose industries are deemed sensitive and subject to regulation are bound to have high agency costs (Watson et al., 2002). To minimise the agency costs and limit further regulation that might mean more compliance costs, companies might disclose voluntarily. For proprietary costs, different industries are bound to have different levels of these costs largely

due to market structural differences (Oliviera et al., 2006). Thus depending on the level of competition prevailing in a particular industry, barriers to entry or exit and what constitute private information in an industry, firms in the same industry are expected to disclose more or less information. In addition, there are some market norms and practices that differ according to industries. The expectation is that a firm in a particular industry is to behave in similar pattern to peers if it is to be deemed within the institutionalisation of that industry. Therefore, in this case, normative and mimetic forces might influence a firm to disclose voluntarily if such disclosures are an expected norm in that particular industry even if there no legal requirement (Holland, 2005). Related to this is an issue of a firm desiring to signal to other parties that it is within the bounds of the industry. Giner (1997) argued that if a firm is seen to deviate from the industry norms, the market may perceive it as bad news hence the firm might use disclosures as a signal of being in line with industrial norms.

In industries where activities have a significant impact on social and environmental issues, voluntary disclosures are explained from the legitimacy perspective. These industries are likely to have high public visibility and in most cases might be subject to negative publicity by the media. In these circumstances, disclosures are used a way of gaining/defending legitimacy (Patten, 1991). Thus, it is believed that the disclosure of information like social responsibility information enhances a firm's public image in the face of its various political interest groups (Deegan and Gordon, 1993).

With regard to climate change and GHG disclosures, the issue of industry influence is a paramount one. Industries differ in their pollution levels as such those industries whose firms emit more GHGs are likely to be under greater scrutiny and subject to regulation compared to less emitting industries (PWC, 2008). Such scrutiny means increased business risks and the need for the concerned firms to invest in less carbon intensive industries (Rankin et al., 2011). The level of pressure in these energy intensive industries and those industries that rely on fossil fuel might influence disclosures in a way that might be different in those industries deemed to be less GHG emitters.

Empirical evidence regarding the influence of industry on voluntary disclosures has been mixed. Stanny and Ely (2008) examined the factors the influence voluntary disclosure of information related to climate change in a sample of 500 S&P firms participating in the CDP and found that contrary to their prediction, there was no positive association between high carbon intensive industries and carbon disclosures. The results by Stanny and Ely (2008) could be due to categorisation of the industries because even financial and technology

industries were deemed carbon intensive. Such sectors do not normally fall under carbon intensive category as per Kyoto Protocol (see Freedman and Jaggi, 2005). But in another study of determinants of voluntary corporate GHG disclosures in Australia, Rankin et al. (2011) found that those companies belonging to energy & mining and those deemed as 'industrial firms' and hence high carbon intensive were disclosing more than companies in other industries.

The influence of industry on disclosures is also confirmed by Hackston and Milne (1996). The authors examined the determinants of Social and Environmental Disclosures (SED) in the 1992 annual reports of 47 New Zealand companies using regression analysis. Results indicated a significant positive relationship between industry and the SED. They argued that industry represents the 'perceived risk' of the company's activities as such firms belonging in industries considered risky in some respects and are subjected to stringent scrutiny discloses more information as a way of reassuring existing and potential investors that all is well. Other studies who found similar results include Patten and Crampton (2004) and Roberts (1992).

Table 1 summarises some of the studies that have been undertaken so far.

Table 1 Summary of GHG disclosure academic studies

Researcher(s)	**Method and Sample**	**Variables confirmed (Significant)**	**Variables not confirmed (non-significant)**
Freedman and Jaggi (2005)	Multiple OLS regression. Annual reports, environmental reports and websites of 120 public firms belonging to Chemical, Oil and Gas, energy, motor vehicles and casualty insurance industries in 20 different countries	Size, Industry	ROE, Leverage
Stanny and Ely (2008)	Multiple OLS regression. A sample of 494 firms of the S&P 500 firms that responded the CDP5 questionnaire.	Size, previous disclosures, foreign sales	Profitability, Leverage, Industry
Prado-Lorenzo et al (2009)	Multiple OLS regression. A sample of 101 companies from USA, Australia, Canada and the EU.	Size, Country Kyoto Membership, Industry	Leverage, Profitability

Prado-Lorenzo and Garcia-Sanchez (2010)	Multiple OLS regression. A Sample of 283 companies which participated in the CDP6 questionnaire	CEO duality Asset profitability, Company Size, Indebtedness ratio, Meeting number, Board size, Industry	Board Independence (Number of Independent directors), Diversity of board members
Peters and Romi (2010)	Regression. A Sample of 4799 firm year observations participating in CDP questionnaires in 2002-2006 drawn from 28 different countries	Environmental regulatory stringency, Country Market Structure, Cross listing, Firm size, Leverage	N/A
Peters and Romi (2012)	Cross sectional logistic regression. A sample of 1462 firm year observations covering 2002-2006. US firms on FT500 and S&P 500	Firm size, Environmental committee, Presence of sustainability officer	Leverage, ROA, CEO duality and Institutional ownership
Rankin et al (2011)	Multiple OLS regression. Annual reports, sustainability reports, stand-alone environmental reports of 187 ASX 300 firms in 2007.	Size, Industry, Participation in CDP, high quality corporate governance, Availability of environmental management system	Participation in EU ETS, Leverage, Board Environmental committee and ROA were insignificant

Berthelot and Robert (2012)	Multiple OLS regression. A Sample of 64 Canadian public oil and gas firms with production activities	Size, ROA, environmental committee and ownership structure (i.e. widely held ownership)	Type of Audit firm.
Stanny (2011)	Logistic regression. A Sample of 442 firms which participated in CDP from 2006-2008	Previous disclosures, Size, Regulatory threat, Price volatility	Share turnover
Cotter and Najah (2011)	Multiple OLS regression. A sample of 356 firms on FTSE Global Equity Index series	Institutional investors, Size, Country	Leverage and ROA
Tang and Luo (2011)	Multiple OLS regression. A sample of 243 companies from G500	Size, leverage, industry membership, participation in ETS, stringent environment regulations	Kyoto Protocol participation by country, Legal System, ROA, Tobin's Q

Source: own construction

3.2 Overview of Qualitative Studies on GHG and Environmental Disclosures

Apart from the quantitative studies that explain the determinants of disclosures from statistical relationship, there are other studies that have been conducted qualitatively to provide further explanations for the motivations (through primary data analysis) and review actual GHG information disclosed by the companies (through qualitative analysis of secondary data). Regarding GHG disclosures, the majority of the qualitative studies particularly focus on evaluating secondary data with the intention of understanding the 'spirit' or genuineness of the disclosures in the voluntary reporting regime. For instance, Kolk et al. (2008) developed a conceptual framework using the global governance theories and institutional theory in order to investigate the role of carbon disclosures in an emerging climate change regime. Their study focussed on data disclosed through CDP with an objective of analysing the effectiveness of the CDP disclosure avenue in terms of whether it provides satisfactory information linking climate change strategies, financial performance, and GHG emissions reductions to enable such stakeholders to make decisions regarding a firm. The sample comprised FT500 firms that responded to CDP questionnaire for the period 2003 to 2007 and was analysed qualitatively using QSR NVivo 7 software package. The authors noted that the response rates had gone up but the comprehensibility of the responses remained questionable. They argued that lack of comparability and verifiability of the submitted data meant that even an experienced climate data analyst could not make sense of the CDP disclosures. They then called for a stricter standardised regime of carbon disclosures with mandatory verification requirement as a way of improving the disclosures.

In another study investigating whether the GHG disclosures were being used as 'legitimation strategy', Hrasky (2012) used content analysis of sustainability and annual reports of ASX top 50 companies for the period 2005 and 2008. The aim was to investigate whether companies' disclosures were a reflection of symbolism or apparent change of behaviour leaning towards legitimisation of their operations. The study noted that firms in carbon intensive industries had legitimately increased their footprints information with disclosures showing clear intent to control emissions whereas those in less carbon intensive industries had disclosed as mere symbolism. With these findings, it recommended government intervention through regulation to change the behaviour of less carbon intensive firms and encourage efforts done by those in carbon intensive industries. However the study had a small sample and had concentrated on large companies only.

Haque and Deegan (2010) investigated the climate change disclosures related to

corporate governance made in annual reports, stand-alone social and environmental reports over a 16 year period from 1992 to 2007. The focus was on procedures available within a firm to address climate change issues. The sample was made up of five companies listed on Australian Stock Exchange namely BHP Billiton (manufacturing/mining), Caltex (oil refinery), Origin Energy Limited (oil, gas, and electricity), Rio Tinto (manufacturing/mining) and Santos Limited (oil and gas). Their results indicated that disclosures increased over the period and this was matched with increased corporate governance mechanisms relating to climate change within the firms. Thus in the latter years focused by the study, many firms had reported either instituting a committee responsible for environment and climate change or increasing board oversight responsibilities towards climate change.

The authors also noted that more disclosures relating to GHG accounting and 'research & development' (for example, information about GHG inventory, GHG reduction targets from facilities and products, and the promotion of energy efficiency by developing low emission technologies) was being reported in standalone social and environmental reports compared to annual reports. However information pertaining to governance and management of GHG was being exclusively reported in annual reports. Overall, Haque and Deegan (2010) noted that the disclosures provided limited insights into climate change risks and opportunities and that almost all the companies in the sample failed to meet what they had referred to as 'best practice' based on their disclosure index.

Furthermore, Andrew and Cortese (2012) carried out an exploratory study on the carbon disclosures of Australasian mining companies over three years (CDP5; CDP6; CDP7) in compliance with a voluntary carbon disclosure regime – the Carbon Disclosure Project (CDP) – and assess those disclosures with respect to comparability, an important criterion for information usefulness. The analysis paid particular attention to the methodology used by firms in computing the disclosed information with a view of judging the comparability of the information. Beginning with CDP5, firms reporting under the CDP were advised to use the GHG methodology for the preparation of their information with a view of improving the comparability of the data. Out of the total sample of 46 companies that were requested information in one or more occasions in the period under review, only 18 provided responses. Of the 18 companies that did respond, only 13 disclosed information regarding GHG emissions, with the remaining 5 providing no emissions information. Firms that disclosed the GHG information used different methodologies of computing data despite CDP advising the GHG protocol. This then means that comparability of the data under CDP is still difficult.

Other studies have investigated the credibility of GHG disclosures in other reports other than the CDP. Dragomir (2012) reviewed the annual sustainability reports of the sample companies (i.e. BP, Total, Shell, BG Group and Eni) in order to assess whether they were providing high-quality environmental disclosures at group-level for the period 1997-2010. In this qualitative study, the author benchmarked the carbon disclosures in the sustainability reports against the requirements of GHG protocol. In all the companies sampled, the study revealed lack of consistency in the methodologies used to compute GHG emissions data. Thus the author remarked that it appeared 'the process of calculating and estimating GHG emissions is reformed every year, with disregard to previously collected data and the principle of comparability' (Dragomir, 2012, p.234). It was also found that the disclosures considered 'mandatory' under the GHG protocol like breakdown on the six gases covered by Kyoto protocol were being omitted in the company reports. There was also lack of clear labelling of information according to scopes as is required under the GHG protocol. The author argued that lack of the consistency in the disclosures undermines the credibility of the disclosures and that it pointed to the anomalies and loose procedures in the European regulatory system. Overall the study concluded that existing environmental accounting systems were still far from producing both credible and reliable data.

In a related development, researching on the relevance of the GHG disclosures in various reporting channels including the CDP, Sullivan and Gouldson (2012) focussed on UK major supermarkets. Thus, they researched on the relevance of the voluntary disclosures of GHGs by reviewing the published reports (corporate responsibility reports, the supplementary corporate responsibility and climate change-related information provided on company websites, and on responses to the CDP) of the nine major supermarket groups in the UK (ALDI, ASDA, Co-operative Group, LIDL, Marks and Spencer, Morrisons, Sainsbury's, Tesco and Waitrose) for the year 2010. The findings were that voluntary reporting in supermarkets did not meet investors' needs. There was generally lack of comparability in the data disclosed and that this was more pronounced in indirect emissions from supply chains. Of the studied supermarkets, only Marks and Spencer had disclosed emissions from supply chains. One reason cited as contributing to lack of improvement in the CDP disclosures is that they are not widely used by the investors to evaluate corporate performance hence firms do not have pressure to improve. They also noted that initiatives in improving GHG reporting had placed much emphasis on listed companies so much so that there was a high risk of neglecting disclosure practices in unlisted companies. The authors argued that a clear

government position like introduction of mandatory reporting requirements might go a long way in improving carbon reporting and incentivising investors to use disclosed information.

Other studies particularly those focussing on Social and Environmental Reporting (SER) have gone beyond a content review of information to testing primary data in order to explain the determinants and motivation behind the disclosures. Wilmshurst and Frost's (2000) study examined the link between factors influencing disclosure of environmental information and the actual reporting practices. Using opinions of Australian firms' CFOs obtained through a questionnaire survey and the firms' actual reporting practices extracted from annual and other reports, they found significant correlations between the perceived importance of a number of factors and the reporting practices. The authors failed to find support that practitioners consider environmental groups highly in their disclosure decisions. The only other study that used primary data is that by Cormier et al. (2004) who used a questionnaire survey to determine management's perceptions regarding importance of motives for environmental reporting. In particular senior environmental executives were asked about the determinants of environmental reporting and the responses were regressed against actual disclosures of the firms drawn from Europe and North America. A relationship was found between managers' environmental attitudes towards various stakeholder groups and actual disclosures made.

Buhr (2002) used interviews in her case study approach of two Canadian companies and documented evidence that SER is a complicated process which varied significantly between the two firms. In one company, a dominant motivation was investor pressure whilst in the other it was the presence of one influential individual. Gray et al. (1995b) looking at how SER is implicated in organisational greening came to a similar observation that the presence of a dominant personality had a huge influence on the disclosures. Arguably, if this was to be viewed from the angle of quantitative studies that hypothesise using the presence of dominant CEO or duo roles played by CEO, the result might be deemed contradictory. Quantitatively, most studies tend to conclude that CEO duality (proxy for dominant personality) may deter disclosures. It is simplistic conclusions like these that justify more studies qualitatively.

Another qualitative study that demonstrates the complexity and diversity of motivations behind disclosures is the one done by Larrinaga-González and Bebbington (2001) who researched on whether there was connection between central values of an organisation and SER in nine Spanish companies. Their findings suggest that an organisation

response to environmental affairs reflects both the need to change the environmental agenda and the need to change its values thereby highlighting the fact that motivations behind SER are complex.

In a related development, Adams (2002) attempted to look at the factors affecting disclosures from a different angle. Using seven multinational companies operating in the chemical and pharmaceutical sectors in the UK and Germany, she argued that beyond the traditional factors widely documented in literature as to influence social disclosures there are also other internal factors that affect disclosures. This argument was pursued using primary data collected through interviews and she indeed found other factors like organisational culture and country of origin as just influential as size. The study further noted that the way an organisation structures itself also influences the outcome of the SER. Evidently the findings in these studies are peculiar and cannot be deduced by quantitative statistics derived from secondary data as is normally the case with many studies.

Particularly focussing on the UK, Miles et al. (2002) qualitatively concluded that organisations undertake SER because of four main reasons as follows: peer pressure and benchmarking activities; stakeholder pressure; government pressure; and pressure from the city. Their study further elaborated that through responding to pressure, SER benefits a company on a number of things ranging from enhanced external reputation; external recognition via awards/ ranking exercises; increased staff morale; and 'business drivers, such as cost or risk reduction.

Furthermore, Spence and Gray (2007) conducted interviews with managers in 36 UK firms in an attempt to understand what motivates them to undertake SER. The interviews were based on the themes as identified by Adams (2002) and they were semi structured. The pilot study indicated that business case motivations were predominant and that respondents equated SER to CSR. The motivations were summarised as follows: Business efficiency; Market drivers (ethical investment decisions by stakeholders); Reputation and risk management; Stakeholder management (managing powerful stakeholders like NGOs, Government to forestall future regulatory initiatives); Mimetic motivations (actions as a result of peer pressure); and Internal Champions (the influence of the CEO or board).

Apart from the qualitative literature and quantitative literature depicting motivations behind SER, Spence and Gray (2007) suggested that there is also the 'business/professional' literature whose conclusion point to the fact that there is only a business case to SER and that

is managing risks. Thus the professional literature seems to suggest that engagement in SER could be an effective way of managing risks which might be rewarding in the long run.

3.3 Limitation of Disclosure Literature and Expected Contribution of Study

In brief, studies on GHG disclosures have had the following characteristics: reliance on CDP data; mostly cross sectional with exception of a few; and more importantly none has attempted to test primary data instead most of the determinants are derived through statistical relationships based on secondary data. The dominance of cross section studies and lack of studies testing primary data are characteristics that are common to voluntary disclosure studies in particular those focusing on Social and Environmental Reporting (SER). Such lack of variety in the studies has led to little understanding in what really motivates firms to engage in these voluntary disclosures (Spence and Gray, 2007).

Over the period researchers have attempted to provide answers as to why corporations engage in SER other than mere desire for accountability (Gray et al., 1995a). GHG reporting is largely voluntary in the UK and this makes the question as to why organisations engage in it relevant. Understandably, Solomon and Lewis (2002) wondered why organisations engage in SER when the motivations are unclear while the disincentives are obvious. Quantitative studies have attempted to provide an answer to this puzzle. As discussed, these have led to revelations that SER could be a product of a number of theoretical frameworks namely, legitimacy (Deegan, 2002), stakeholder (Roberts, 1992), political economy and positive accounting (Tinker et al., 1991 (see Chapter 2 for further details). Through many of these studies, it is known that disclosures can be linked to various attributes of a firm (see above for detailed coverage).

Though the theories have helped clarify the motivations, there is sense that what has been concluded so far is partial, contradictory and inconclusive leading to the need for more different patterns of research (Spence and Gray, 2007). Researchers note that the problems lie in the inherent limitations of the statistical methods used in inferring the motivations for disclosures (Roberts, 1992; Miles et al., 2002). This led to a number of researchers resorting to qualitative studies (see Adams, 2002; Buhr, 2002; Gray and Bebbington, 2000; Gray et al., 1995b; Larrinaga-González and Bebbington, 2001; Larrinaga-González et al., 2001; O'Dwyer, 2002) whose results have suggested that quantitative explanations for SER are underestimated, and that in reality motives or determinants for disclosures are complex and variable (Spence and Gray, 2007). The argument is that the thinking, emotions of people

behind the production of the disclosures cannot be explained by statistical numbers which in many cases are historical and produced for other purposes (Miles et al., 2002). Therefore it is intimated that an alternative or complementary way of determining these motivations is to use qualitative approach through surveys or interviews. Spence and Gray (2007) argued that such an approach will help highlight the internal struggles between balancing corporate objectives leading to the disclosures.

It is believed that through studies involving primary data; more insights could be uncovered leading to clear understanding of the motivations and appropriate policy frameworks to encourage those not fully engaged. This is important in the study of GHG since to date, most of the studies have limited themselves to how the theories explain the phenomenon behind GHG disclosures. Thus part of what is lacking in the GHG disclosure literature is a systematic review of how those preparing reports for GHG disclosures articulate the company determinants for the same. One advantage of primary data is that it is able to obtain specific responses to a specific question unlike in secondary data where a proxy for say size might represent a number of things ranging from political costs, firm risk to environment influence (Graham et al., 2005). Appreciation of a firm's internal and external factors that motivates its disclosure policy through a survey is helpful in setting up any policy on GHG disclosures. Thus, evidence abound that the understanding of firm specific determinants is important in helping identify and highlight challenges or obstacles to the success of future regulatory efforts (Peters and Romi, 2010). Tauringana (1997) also pointed out that one importance of disclosure is that they help recommend or influence policy. But just as May and Sundem 1976 cited Graham et al. (2005) mentioned, policy adoption is as a result of the application of a choice among several alternatives and often a highly subjective judgemental process which in the opinion of Graham et al. (2005) can only have a sound grounding if supported by empirical evidence emanating from primary data. In the circumstances, one contribution of this research is that its results will help shape policy on GHG disclosures at a time when the government is stepping up efforts to ensure more GHG disclosures by companies.

Notwithstanding the above, Spence and Gray (2007) advised that the emphasis on qualitative studies should not mean a disregard to quantitative studies rather they should be used complementary. In view of this, this study will make use of both methodologies to understand the motivations behind GHG disclosures.

In addition to bringing insights through primary data, this study also brings the

understanding of GHG disclosure determinants on a longitudinal basis. Voluntary disclosure literature is dominated by studies that have focussed on a single period (Bartlett and Jones, 1997). Over time attempts have been made to conduct studies on a longitudinal basis (see Choi, 1974; Firth, 1980; Barret, 1976). Critics of these studies point to the fact that they were based on annual reports that were purely formulated from stewardship point of view unlike in recent times when the annual report has been transformed into a public relation document (Bartlett and Jones, 1997). Recent studies on longitudinal basis include that of (Gray et al., 1995a; and Lee, 1994) but these have not directly investigated the question of determinants (Bartlet and Jones, 1997). In trying to improve on the shortfalls of earlier and current studies on longitudinal basis, Bartlett and Jones (1997) carried their own but its major limitation is that it only focused on one company i.e. H.P. Bulmer Holdings and that limits its applicability. Studies as conducted by Stanny and Ely (2008); and Kolk et al. (2008), though fall under longitudinal studies specifically focussing on GHG yet they have inherent limitations in their use of CDP questionnaires. It is therefore intimated that a study that is done on a longitudinal basis using a modern form of annual report, covering a number of companies in diverse industries may provide useful insights to the general literature of disclosures since longitudinal studies tend to produce robust results (Oliveira et al., 2006).

The relevance of longitudinal studies is well documented in literature. Brammer and Pavelin (2006) noted that a longitudinal study helps to highlight an evolving pattern of disclosure over time and the results of Rajab (2009) on risk disclosures in the UK, though done based on random years chosen over time supports this view. Other accounting disclosure studies particularly in social and environmental spheres have also displayed a pattern of increasing in response to a number of factors specifically regulation and public pressure (Haniffa and Cooke, 2005). Therefore it is anticipated that this longitudinal study will reveal the trend of disclosures over time while noting the factors and motivation behind the same. This is particularly important in the UK setting since the period covered by the study is characterised by an increase in government initiatives relating to GHG reporting. Thus under the strong leadership of the government, the Climate Change Act 2008 and DEFRA guidance 2009 were introduced to help companies account and disclose GHG information and hence the need to assess the effectiveness of these initiatives.

The study also makes a general contribution to the existing gaps in the disclosure literature. In fact prior researchers (see Zarb, 2007) have called for more studies exploring the motivation and determinants behind disclosures arguing that despite many studies in this area

the motives have not been satisfactorily defined (Hackston and Milne, 1996). Again Adams (2002) called for more studies testing primary data to reveal the determinants behind disclosures arguing that these voluntary disclosure motives cannot be obtained by testing secondary data of certain selected variables alone. Other prior studies like that of Gray et al. (2001) and Patten (2002) also argued that results from existing studies on disclosures particularly environmental information are inconclusive owing to many limitations of the studies and hence called for more studies in this area. Among the limitations cited are sample size and lack of industry diversity. These will be addressed in this study by investigating more companies drawn from a diverse range of sectors and hence it is therefore believed that the findings of this research will go a long way in expounding current knowledge on motives of disclosures in general. In addition there is a general call by researchers like Rankin et al. (2011) for more studies exploring the motivations behind GHG disclosures and this study is part of the response to those calls.

This contribution is enhanced by the fact that the study is localised to one country i.e. UK while covering a diverse range of sectors unlike previous studies on GHG disclosures that have an international focus (covering many countries) but a narrow industry coverage. Thus previous studies have covered many countries but selective industries largely drawn from the Kyoto protocol document (Prado-Lorenzo et al., 2009; Freedman and Jaggi, 2005). The rationale behind wide coverage in this study is that the most widely available GHG reporting frameworks are generic and applicable to all companies.

The focus on one country is important in as far as results are concerned. As noted by Kolk (2010); Prado-Lorenzo et al. (2009), though climate change is a global problem, it affects countries differently as such policy guidance tends to reflect the effects experienced by a country and this may adversely affect international comparison. Gray et al. (1995a) in a review of environmental disclosure literature concluded in similar manner stating that a country of origin has a huge influence on disclosures. When researching on Corporate Social disclosures, Adams (2002) came to a similar conclusion. Other researchers have also singled out country of origin effects as a major limitation of international studies noting that voluntary disclosures are very much a reflection of mandatory disclosures which are heavily influenced by a country's legal system (Einhorn, 2005; Zarb, 2007; Holland and Foo, 2003). In direct reference to GHGs Peters and Romi (2010) argued that different countries continue to develop numerous reporting mechanisms for GHGs hence making firm or country comparison difficult. Their study of CDP disclosures of companies drawn from different

countries revealed that company disclosures differed based on country in which a company was based. In the circumstances therefore it is justifiable that GHG disclosures which fall under climate science, an area where the public has divided opinion, should be studied in a local setting.

The choice of UK is justifiable in the sense that despite setting ambitious targets on GHG reduction and introducing a number of initiatives to lead the corporate sector into 'green economy' very few academic studies have done to assess the disclosure practices of companies targeted by these initiatives. So far available studies on GHG practices in the UK have largely focused on what is being disclosed rather than the determinants behind the disclosures (see for instance, Sullivan and Gouldson, 2012 who focussed on GHG disclosures of UK major supermarkets). Others like Sales de Aguiar (2009) focused on testing the impact of joining the UK ETS scheme on Global Climate Change disclosures. Using CDP data, standalone reports and annual reports covering the period 2000 to 2004 she documented evidence that participation in the UK ETS scheme had increased disclosures on global climate change mainly in the annual reports. This study has some limitations. DEFRA (2010) noted that though Schemes like UK ETS or EU ETS are important initiatives, they do not emphasise on accounting and reporting GHG which then makes a reading of the company's disclosures under them limited.

A case could also be made that with the introduction of further voluntary reporting guidance like DEFRA (2009), the UK deserves more review as to the impact of such documents on the company's disclosure behaviour not only in CDP disclosures but also in the annual reports.

3.5 Chapter Summary

The chapter has provided a comprehensive review of the literature on voluntary disclosures particularly those focussing on GHG and environmental disclosures. This was done with the intention of putting the current study in proper context. Thus such a review helped identify the gaps in literature which the current study purpose to address. In doing this, the chapter has covered a number of characteristics which are deemed necessary for a disclosing firm. These include corporate governance attributes (board size, non-executive director ratio, audit committee independence, and environmental committee), ownership structure (managerial ownership, ownership concentration), and company characteristics like (size, profitability, liquidity, leverage, industry). The emphasis was on clearly identifying the link between these

factors and the theories on motivation for voluntary disclosures discussed in chapter three. It has therefore been demonstrated that GHG reporting just like environmental reporting is likely to be done by large companies; by organisations in high sensitive industries; and good corporate governance which among other things is characterised by presence of environmental committee. It has also been shown that these characteristics reflect the applicability of the theories and that in some circumstances other characteristics like size might represent the nature of more than one theory. This confirms the fact that the theories complement one another in explaining the motivations behind disclosures.

Having looked at the determinants of the disclosures, the chapter had a detailed coverage of selected qualitative studies whose focus was on social and environmental disclosures with a particular emphasis on those concentrating on GHGs. The analysis was aimed at bringing more insights into the findings of these studies by reviewing their salient features like sample used, methodology adopted and how the results differed from one study to the other. Compared to the quantitative studies, it has been demonstrated that very few qualitative studies on GHG disclosures have been done with the majority heavily relying in data extracted from CDP questionnaires. In all, the analysis has revealed that though GHG disclosures are being studied more, the studies are mainly quantitative and cross sectional and in many cases have relied heavily on CDP data. There is also evidence of inconclusiveness as to what really motivates firms to disclose GHG information despite the associated costs of such disclosures. Thus the chapter has shown that this reliance on secondary data based quantitative studies to understand determinants hugely underestimate the dynamics of parties involved in the disclosure processes and that for some time researchers have recognised this limitation. In overcoming this limitation, some researchers on SER have resorted to qualitative studies. Evidence coming from these qualitative studies suggests complex and conflicting factors motivating disclosures but many agree that no single approach is adequate in explaining these disclosures. No study on GHG has attempted to test primary data and in as far as the researcher is concerned, no study on SER has combined both methodologies in one attempt to understand the motivation behind disclosures. It is in this respect that this study has been taken to fill this gap.

In addition, the chapter has also justified the setting of the study being on UK companies and on a longitudinal basis. Few studies on voluntary disclosures have been on longitudinal basis but literature demonstrate that such studies bring a wealth of insights and trends in the disclosures which is what this study intends to establish on GHG disclosures.

Thus a longitudinal study will help track how GHG reporting has developed which may provide useful guidance as to what is not been reported and tracking where the major failures are in achieving reporting completeness. Regarding the choice of UK companies, at the time of this literature review, to the knowledge of the researcher, only one study focused on the UK examining the impact of joining EU ETS on climate change disclosures. It is appreciated that a number of initiatives notably the introduction of Climate Change Act 2008 and voluntary GHG disclosure guidance i.e. DEFRA (2009), makes the UK an interesting case to review the motivation behind the GHG disclosures.

CHAPTER FOUR

The Nature of Greenhouse Gases

4.0 Introduction

The aim of the chapter is to explain the nature and importance GHGs so as to highlight why they merit attention and require meaningful coordination at the international level. In doing this the chapter begins by laying down the scientific background of climate change and global warming. The composition and particular features of GHGs are explained and thereafter the link between human influence on GHGs, climate change and temperatures is briefly outlined. Having demonstrated why human influence is singled out as being responsible for global warming, the chapter covers some criticisms made against the scientific claim behind global warming. The impact of global warming is discussed after the criticisms which then lead to the discussion on the economic justification for policy intervention on global warming both at national and international levels. The chapter concludes by looking at the efforts and agreements that have been done so far in addressing the issue of climate change. These efforts have been discussed at two levels first focussing on international efforts and then secondly looking at UK efforts. International efforts dwelt on United Nations negotiations beginning with the formation of IPCC in 1988 through to Kyoto protocol and the Durban platform in December 2011 while a look at the UK has concentrated on the policy measures implement to help it meet its domestic as well as international GHG emission reduction targets.

Throughout the chapter, emphasis is made that GHGs and global warming have become topical issues in our time so much so that no stakeholder can afford to neglect them. Thus there is a tension between the desire for continued economic development through means that bring GHGs and the need to preserve a habitable universe through good environmental management. In achieving the right balance, the international consensus is about a shift to economies propelled by clean energy and decelerating on the use of carbon intensive energy. To ensure that these goals are met, policy interventions are in place meant to help stakeholders manage their emissions and invest in green technologies. But for progress to be noteworthy there must be accountability and transparency which will ensure that all stakeholders are aware of each other's contribution to climate change and efforts to manage the same. Transparency and accountability is achieved when there is a credible

system of measurement and reporting. It is in this respect that measurement and reporting of GHGs becomes a pivotal element in all efforts developed so far to manage GHGs. Some evidence indicates that measurement and reporting enables a firm to manage its emissions (Deloitte, 2011). Nonetheless reporting on its own does not lead to companies reducing their emissions rather its policies that encourage companies to measure emissions of which reporting is one of them that lead to GHG reductions (DEFRA, 2010).

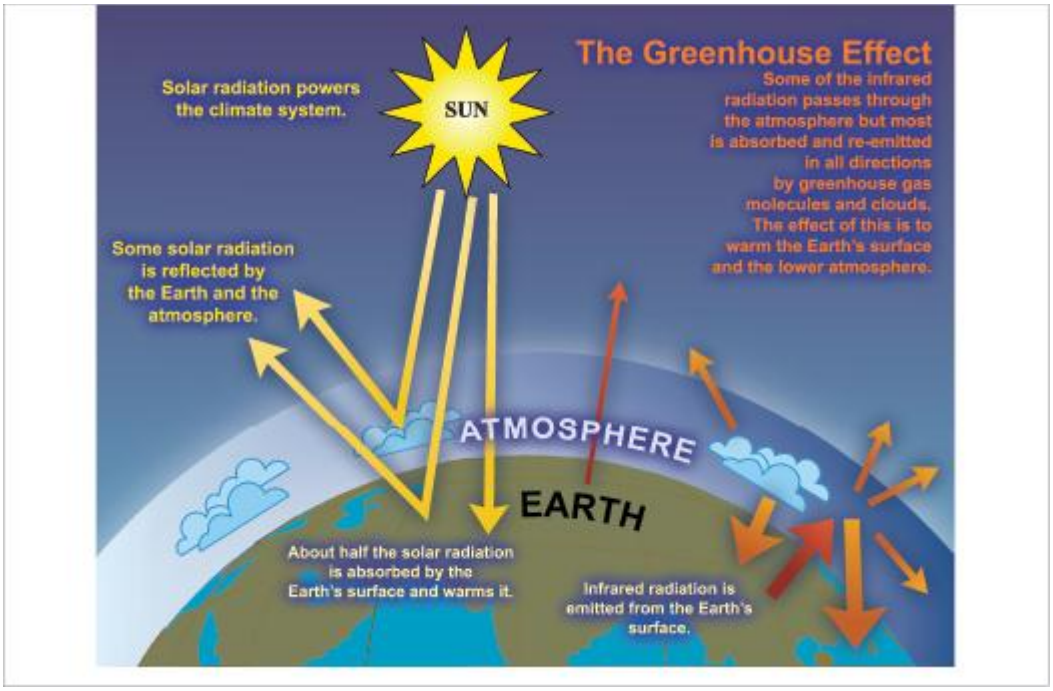
4.1 The Science of Climate Change

The GHGs science is explained within the context of climate. IPCC (2001) defined climate as an average of weather (wind, precipitation, temperature etc.) over time and area. The climate system is powered by solar radiation and evolves over time under both its own internal dynamics and external factors referred to as 'forcings' (IPCC 2007). Changes in solar radiation are considered to be a major factor that alters climate patterns.

Scientifically, it is estimated that when solar radiation occurs, energy amounting to 1,370 watts reaches the earth per second on a surface area of one square meter facing the sun during the daytime (Le Treut et al., 2007). Approximately two third of this heat is reflected back due to clouds and other particles while the un-reflected portion is absorbed by the earth's surface and atmosphere. To keep a balance of the incoming energy and outgoing energy, the earth theoretically radiates the same amount of radiation it absorbs (Seinfeld, 2011; IPCC 1995). It is through this process that the earth maintains its climate levels and hence any change to radiation is bound to alter climate pattern.

Nonetheless as the earth radiates back the solar energy, before it reaches the space, part of the energy is trapped in the atmosphere by the presence of some molecules referred to as Greenhouse gases. They are called Greenhouse gases because they hold heat like glass walls of a greenhouse (IPCC, 2007). The trapped heat is reradiated into different directions and this process reduces the heat released into space thereby enabling the earth experience warmer temperatures than it would otherwise. The ability of the GHGs to hold the solar energy and radiate it back to the earth making it experience warm temperatures is what is known as Greenhouse Effect (The Australian Academy of Science, 2008; Florides and Christodoulides 2008). The gases identified to have this effect are mainly water vapour and carbon dioxide but the effect of the latter is significant due to its life span in the atmosphere (Le Treut et al 2007). Please refer to figure 1 below for an illustration of the greenhouse effect.

Figure 1 The Greenhouse Effect Illustration



(Source: Le Treut et al 2007. Historical overview of climate change. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change)

Figure 1 illustrating the movement of solar radiation from the sun to the surface of the earth and back into space. The term Albedo is used to refer to the percentage of solar energy that is reflected back by the surface and scientists use the understanding of local, regional, and global Albedo to help project climate change. Furthermore scientists believe that the warming effect of the gases is kept in balance by the right amount of the gases in the atmosphere. It is this right balance that ensures that the earth maintain appropriate levels of temperature to sustain life (Le Treut et al., 2007).

4.2 The Greenhouse Gases Composition

The atmosphere is made up of several gases of which 21.0 per cent is oxygen and 78.0 per cent is nitrogen while the other gases constitute the remaining 1.0 per cent (Australian Academy of Science, 2008). According to IPCC (2007), nitrogen, oxygen and the other atmospheric gases that exist naturally constitute 99.0 per cent of the gases but do not have any greenhouse effect. The greenhouse effect occurs by the influence of the remaining 1.0 per cent of the gases of which carbon dioxide is about 0.038 per cent. The largest GHG is water

vapour whose portion ranges from a fraction of 1.0 per cent to about 3.0 per cent of the total atmospheric gases (IPCC, 2007). Apart from the water vapour and carbon dioxide, there are other gases that also exhibit the greenhouse effect. Those as identified by the Kyoto protocol (1997) are Methane (CH_4), Nitrous Oxide (N_2 0), Hydrochlorofluocarbons (HCFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF_6). However in the second phase of the Kyoto Protocol which covers a period from 2013 to 2020, nitrogen trifluoride (NF_3), has been added to the list of the gases (UN, 2012).

Generally it is the right balances of the GHGs that help the earth maintain stable climate patterns to support life. Disequilibrium of the concentration of such GHGs can provoke a change in the earth's climate with effects on surface temperature, precipitation and severe weather phenomena, such as hurricanes and extreme flooding (Jenowein et al., 2010). However among them, each gas has a different potential of influencing the greenhouse effect. The influence is mainly as a result of concentration and life span of the gases in the atmosphere (Le Treut et al., 2007). Scientists acknowledge that GHGs other than carbon dioxide have a greater warming potential but their concentration and life span is less than that of carbon dioxide hence making the latter an important GHG (IPCC 2007). The warming potential of each gas is calculated in the unit called Global Warming Potential (GWP) which compares the warming potential of each gas to that of carbon dioxide. IPCC (1990) defines the GWP of a particular GHG as the ratio of the integrated radiative forcing of the GHG over a time horizon to that of CO2 after their instantaneous releases to the atmosphere in the amounts of 1 kg. GWPs are used to convert the emissions of non-CO2 GHGs to 'equivalent' CO2 emissions, allowing policy-makers to consider and compare multiple options for GHG emission reduction (Tanaka et al., 2009). Due to the fact that gases do not stay forever in the atmosphere, the GWP is determined over a specific time interval of which the standard times are 20years, 100 years and 500 years. The other GHGs other than carbon dioxide have very large greenhouse effect but it is their concentration and life span that tends to weigh down this influence. According to IPCC (1995) and Jager and Ferguson (1991) it is estimated that the global warming effect of carbon dioxide is 61.0 per cent followed by Methane at 14.0 per cent and all the others falling below 5.0 per cent over a 100 year period. Such influence is attributed to concentration and life span.

4.3 The Link between the Existence of Atmospheric Greenhouse Gases and Human Influence

As noted, the earth maintains predictable patterns of climate by having the right balance of the GHGs. Without any human intervention, nature has a mechanism of ensuring the right concentration of the gases as most of them appear and disappear naturally. For instance carbon dioxide, an important GHG, is produced naturally when people and animals breathe and is absorbed by plants for their survival. Volcanoes are also believed to produce carbon dioxide. Nitrous oxide is produced when plants die and rot while methane is known to come from cattle as they digest their food (IPCC, 2001).

However in the process of time, scientists began to document evidence of human influence on the concentration of GHGs in the atmosphere. According to Maslin (2004), Svante Arrhenius was the first to claim that human activity like fossil fuel combustion was one cause of global warming linking the concentration of carbon dioxide to temperature. Later substantial evidence of his claim was found by scientists and it became widely recognised in the public domain that human activity was partly responsible for the increased concentration of some GHGs notably carbon dioxide.

According to Forster et al. (2007), human activity primarily result in emission of four principal GHGs namely carbon dioxide, methane, nitrous oxide, and the halocarbons group of gases containing fluorine, chlorine and bromine. It is the accumulation of these gases over time which increases their concentration thereby affecting their warming influence in the atmosphere. The human influence on the concentration of the GHGs is referred to as anthropogenic. Evidence exist that significant increases of these GHGs have occurred due to human activity since the industrial era began (IPCC, 2007; The UK climate Change Programme, 2006). Scientific evidence show that due to a combination of fossil fuel combustion and deforestation, the amount of carbon dioxide increased from 275 parts per million by volume before 1800 to about 355 parts per million by volume in the 20th century (Lindzen, 2010).

As a matter of fact, there are a wide range of human related activities that lead to increased GHGs including burning of fossil fuels, cement production, deforestation, natural gas drilling, coal mining etc. But as Nordhaus (2007) explains, the major problem is the burning of fossil fuels such as coal, oil, and natural gas which leads to the emission of carbon dioxide which then result in an imbalance of its required concentration in the atmosphere. It is such increased concentration that makes them trap more radiated energy and reradiate it

back to the earth thereby making the earth have warm temperatures. In between 1970 and 2004 GHG emissions weighed by 100 year GWP have grown by 70.0 per cent and the growth of carbon concentration in the same period is estimated to be 80.0 per cent (IPCC, 2007). Scientists established that the surface temperature of the earth has warmed by 0.8 degree Celsius above its level in 1750 due to anthropogenic greenhouse effect and it is estimated if nothing is done to reduce emissions the earth warming may increase by a margin of 2^{o}c by the year 2050 and to between 3 or 4 degrees Celsius by 2100 (IPCC, 2007; Schneider et al., 2010).

4.4 Criticism of Global Warming Science

Criticism principally targeting the fundamental basis of the climate change science is widespread. Critics argue that changes in temperature are merely exaggerations since estimations are only dating back to 150 years ago and that there is too much reliance on recreations based on a number of proxies like tree rings and ice cores (Von Storch et al., 2004 cited Stern, 2006). While this criticism is held by a few, there is also general unanimity to the fact that predicting the impact of global warming in future is not an exact science hence liable to inaccuracies (Stern, 2006). Lomborg (2007) while acknowledging the changes due to global warming argues that the adaptive capabilities of humanity aided by technological changes shall continue to keep pace with the changes. Similarly, Lindzen (1992) argued that even if the earth was to warm up, the internal dynamics of climate are so complex that they cannot just remain constant and that effects of any projected warming levels are manageable.

Furthermore, the IPCC (2007) report where the fundamental science behind global warming confirmed came under severe criticism with many arguing that the finding had unduly relied on ‘grey literature’ mostly newspaper articles without peer review thereby undermining its scientific authority (Furrer, 2010). IPCC acknowledged the criticism and appointed a team of eminent scientists to review the criticised elements of the report (Pachauri, 2010). Despite the criticisms, however, the majority of scientists agree that since the industrial revolution the earth has been warming due to anthropogenic greenhouse effect (IPCC, 2001; Furrer et al., 2009). Overall, using the work Anderegg et al. (2010) who reviewed the work of 1372 climate change researchers publications and citations, Milne and Grubnic (2011) estimated that about 98 per cent of the climate change researchers accept the primary conclusions of IPCC (2007) findings that it is ‘very likely’ that ‘most’ of the ‘unequivocal’ warming of the Earth’s average temperature over the second half of the twentieth century is due to anthropogenic GHG emissions. The IPCC position is further

confirmed in a report issued in 2013 in which it concludes that the warming of the climate system is unequivocal. Thus IPCC (2013) concluded that:

- Warming of the climate system is unequivocal, and many of the observed changes that have occurred since the 1950s are unprecedented over timescales of decades to millennia. Specifically, the atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.

- Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since the 1850s.

- Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90% of the energy accumulated between 1971 and 2010. It is *virtually certain* that the upper ocean (0−700 m) warmed from 1971 to 2010.

- Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent.

- The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia. Over the period 1901–2010, global mean sea level rose by 0.19 m.

- Human influence on the climate system is clear. Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes. It is *extremely likely* (i.e. 95-100% likelihood) that human influence has been the dominant cause of the observed warming since the mid-20th century.

4.5 The Effects of Anthropogenic Global Warming

Without the anthropogenic greenhouse effects, the natural greenhouse effect is a significant factor that enables the earth to maintain an average temperature of 14^{o}c with higher attitudes recording as low as -19^{o}c. It is at these levels of temperature that the earth is able to support life and hence it is feared that any human induced warming of the planet might have dire consequences on the earth's ability to sustain life (IPCC, 2007).

Parmeson and Yohe (2003) cited IPCC (2007) highlight the fact that the ability of climate to determine the distribution of both natural and managed systems makes its changes or variations to be of great concern. Many aspects of climate change affects life patterns on earth but scientists single out temperature changes as one aspect of climate change that provides clear signals of its consequences. According to IPCC (2007), some of the notable impacts of a rise in anthropogenic global warming will be experienced as follows:

- The mortality rate of most species will rise and food supplies will be endangered partly due to extreme summer heat weaves and other effects. Generally the entire cycle of agriculture will be destabilised due to variations in seasonal periodicity resulting in scarcity of food in some areas and a general imbalance between supply and demand thereby driving market prices up.
- Changes in weather patterns affect water cycle resulting in severe floods in other areas while others having severe drought. Flooding often result in migration of people and this has an economic impact. IPCC noted that people will feel the great impact of climate change through its effects on the distribution of water highlighting that when water cycle is affected billions of people will either loose or gain water.
- Sea levels are likely to rise affecting human settlements along the sea. This again necessitates the gradual relocation of people. IPCC (2007) estimates that around 5 per cent of global population live in coastal cities and is bound to be severely affected.
- Warmer temperatures also threaten the survival of vulnerable groups like the aged. In fact by 2002, the World Health Organisation estimated that by the year 2000, climate change was responsible for premature deaths of about 150 000 worldwide (Schneider et al., 2010). Warmer temperatures are also believed to cause migration of disease bearing insects like mosquitoes.

In addition to the effects caused by rising temperatures, IPCC (2007) notes that other impacts are a direct consequence of increased concentration of carbon dioxide. For instance increased levels of carbon dioxide absorbed by the oceans result in ocean acidification which destabilises the entire ecosystem and affect the oceanic food chain. IPCC (2007) further explains that with a warming of around $2^{o}C$ around 15 per cent to 40 per cent of the species potentially face extinction especially when the warming happens rapidly without giving species ample time to adapt.

Furthermore, global warming on its own coupled with its impact on life sustainability

on earth is also expected to affect the business practice of many corporations across sectors and industries since corporations are part of the larger community (Sullivan, 2008; Lash and Wellington, 2007). Impact on production and infrastructure emanating from climate change effects of extreme weather changes, rising temperatures and rising sea levels is known as 'Direct Impact' by IPCC (2007). In particular, Wittneben and Kiyar (2009) explained that as worldwide economic losses due to natural disasters accumulate, climate change related risks and opportunities have to be integrated into core financial operations of all firms regardless of their core business. For instance, Packard and Reinhardt (2000) argued that floods affecting property and people's livelihood through agriculture will heavily affect the property industry and necessitate reallocation of agricultural investments from affected areas to other areas. In most cases investments in affected areas will be rendered useless thereby affecting overall valuation of certain companies. Connected to this is the fact that the construction industry will be confronted with the need to redesign its products in a manner that withstands the effects of the changing weather patterns. Basically as people become affected with weather changes, companies will experience a shift in demand for their products and services (Jenowein et al., 2010). For instance, increase in diseases like malaria will mean more demand for pharmaceutical companies. Generally companies with climate sensitive assets like insurance companies, real estate and agricultural companies will have to devise effective ways of managing risks associated with weather changes and this may require substantial investment in collection of reliable information (Packard and Reinhardt, 2000; Kolk et al., 2008).

Other climate change impact on businesses is expected to come from government actions in attempting to curb GHG emissions (Sullivan 2008). IPCC (2007) refers to this impact as an 'indirect impact' emanating from political frameworks and societal preferences. Bebbington and Larrinaga-Gonzalez (2008) explained with the rise in prominence of global climate change in public policy circles, firms are now confronted with both regulatory and competitive risks emanating from policy instruments developed to tackle climate change. Thus though the scientific basis remain a contested issue, the push for more regulation as was the case within the Kyoto protocol means that the days of 'business as usual' for corporations are over. Business activities like those in manufacturing sectors that generate more GHGs will have to change course as government actions begin to discourage use of fossil fuels either through taxes or any other means. Evidently, any regulation discouraging use of particular substance like fossil fuels in favour of those with low carbon intensity will

result in change of asset values leading to loss of value for those assets depending on heavy fossil fuel and a gain in value of those assets connected with low carbon emissions (Packard and Reinhardt 2000). Enkvist et al. (2008) reported that valuations for "clean technology" companies had increased significantly with the growing prominence of climate change issues. Kolk and Levy (2001) explained that in a 'constrained carbon future', firms face competitive risks as a result of competitive advantage of low intensive goods and services compared to carbon intensive ones. Generally policies placing a price on carbon emissions increase the cost of production and reduce the value of the companies that do not take mitigation action (OECD, 2010). Besides, Berthelot and Robert (2012) stated that, among other things, companies who are emitters will face numerous consequences ranging from increased operating costs, reduced demand, reputational risk, litigation, penalties and increased stakeholder demand for useful information on GHGs. With countries like the UK taking a lead in climate change mitigation initiatives and the private sector in particular institutional investors championing the need for more climate information, measurement and reporting emissions has become the focus of attention by different stakeholders.

Overall therefore, due to the effects of climate change, there will be a re-evaluation of companies' portfolio of assets sensitive to climate change and a rethink of investment strategies in low emitting carbon technology. In general, Rezai et al. (2011) reasoned that devastating effects of climate change will result in loss of the productive capacity of the world economy thereby necessitating action by various stakeholders. In the circumstances, pressure on firms to demonstrate their green credentials has been growing and, in return, firms are strategizing on managing those expectations (Bansal, 2005; Sharma and Henriques, 2005; Kock et al., 2012). However despite the increasing pressure, studies are yet to emerge assessing the extent of disclosures by the pressured firms.

4.6 Global Warming and the Justification for Policy Intervention

Though scientists had been researching on climate change for a long time (Nordhaus, 2007) and the issue of climate change was signalled in the 19th Century (Gupta 2010), it was the rising concerns of the effects of global warming on humanity that help bring the issue to the forefront of public debate (Brown, 1998). Evidently when the side effects of increased carbon concentration was brought to light, humanity found itself in a fix of trying to accelerate economic development on one hand (which resulted in more release of carbon dioxide), and on the other hand the need to control carbon emissions whose increased concentration not only undermined the economic gains but also threaten its survival. Thus the

tremendous progress made by human kind since the industrial revolution is tied to the ability to use fossil energy which is responsible for pollution (van Koten et al., 2009). An increase in economic activity coupled with inaction on global carbon emissions is likely to make the impact of global warming be felt by humanity substantially (Stern, 2006).

Nordhaus (2007) argued that intervention in climate change issues is a dilemma because it is a unique problem in that it is a public good with complex scientific and economic uncertainties. Such being the case, he noted that the challenge is to develop a policy that balances economic costs of action or inaction today to corresponding future economic or ecological benefits. However, as stated by Brown (1998), it is the compelling evidence of the likely consequences of climate changes that have pushed the policy makers to make a move.

A comprehensive economic justification for policy intervention is documented by Stern (2006) who argued that the benefits of controlling emissions far outweigh the costs of controlling the same. Stern (2006) estimated that the cost of acting on GHGs is 1 per cent of GDP while if nothing is done its impact is 20 per cent of GDP. However, it should be noted that there has been criticism regarding the findings of Stern Review with some arguing that the figures are overestimated due to a low discount rate used (Carter et al., 2006; Weyant, 2008). Despite these criticisms the findings of Stern review are highly regarded and were confirmed by the IPCC report in 2007.

Most economic analysis studies on the impact of climate change have so far looked at it in the context of a public good and externality. Stern (2006) explained that climate change is an externality in the sense that those whose action are responsible for climate change are not liable or do not face the full consequences and that the effects are not corrected through market mechanisms on their own hence justifying the need for intervention. The failure by market correction is explained by climate change being a public good. Thus being a public good, markets will be reluctant of developing innovative ways of mitigating the effects for fear of being easily copied by competitors at no cost unless patented. Though an externality and a public good, climate change is unique in the sense that its causes and consequences are global regardless of where emissions occur and that its effects are likely to be felt over a long period of time (Sovacool and Brown, 2007). Stern (2006) argued that these characteristics coupled with the fact that the global warming effects tend to affect the poor more than the rich makes a case for any policy intervention to incorporate ethical and welfare issues.

A study showed that the most effective policy intervention was pricing carbon

emissions so that faced with a charge; emitters will be forced to reduce emissions (Hepburn, 2007). Nordhaus (2007) argued that such pricing may take the form of limiting the number of emissions (Cap and trade) or by levying a tax on carbon emissions. However as noted by Prins and Rayner (2007), the tax policy route is a tricky one due to political consideration more especially to big polluters like the USA while a cap and trade systems requires careful controls in the supply side of allowances if the policy is to achieve emission targets. With this in mind, Stern (2006) recommends that the choice of policy tool should be done at national level after taking into account its interaction with existing policies. While pricing carbon has an influence in making firms switch to low carbon technologies, Stern (2006) argues that to remove uncertainty as to the future viability of any firm's investment in low technology, then other aspects of climate change policies adopted should cover technology aspect.

Nonetheless as rightly highlighted by Stern (2006), climate change being an externality and a global public good, any policy intervention requires international cooperation and the ethical and welfare considerations should be dealt by making rich nations shoulder more burden of carbon emissions reduction than poor nations. This appears to be the direction policy intervention at international level has been taking since 1988 when the IPCC was established. The international negotiations on global warming have followed what is termed as 'common but differentiated approach' where more burden for emissions reduction is placed on the richer nations than the poor and developing nations (UNFCCC 1992).

4.6.1 Global warming policy intervention efforts at international level

Generally many economic policy researchers agree that the economics of GHG reductions suggests that the effective way to handle it is through international corporation (See Nordhaus 2008; Jacoby et al., 2008) since achieving any target set by individual country are unlikely to result in significant reductions (Bosetti et al., 2009; Clarke et al., 2009; OECD 2009). Falkner et al. (2010) elaborates that international cooperation removes the problem of 'free riding' as identified by Stern (2007) to be dominant with climate change as a public good.

In realisation of the benefits of international cooperation, the international community took the first step of cooperation in 1988 with the formation of the IPCC as the scientific arm responsible for climate change science research under the United Nations Framework Convention on Climate Change. The UNFCCC was endorsed by 160 countries in 1992 in Rio de Janeiro (Houghton 2004). While acknowledging the uncertainties surrounding climate

change science, the UNFCCC went on to emphasise the need to mitigate against the effects of global warming and the overall target of cutting emissions by 5.0 per cent by the year 2000 using 1990 levels was set. Falkner et al. (2010) noted that the UNFCCC was modelled from the Vienna convention on Ozone layer depletion and hence it has similar tenets like placing more responsibility on industrialised nations to cut emissions while helping developing nations adapt low carbon emissions technologies. This is referred to as the principle of common but differentiated responsibility (UNFCCC, 1992). It also insisted on commitments from industrialised nations to set targets which will later pave way for a legal binding protocol. Suffice to mention that the short term goal of the agreement was not achieved as by 2000 global emissions had risen by 10.0 per cent on 1990 levels (Houghton, 2004). Gupta (2010) attributes part of the failure to the fact that most of the underlying principles of meeting the targets were vaguely worded, non-participation of key countries like USA and the categorisation of countries into two groups that fuelled more disagreements than necessary.

Notwithstanding the failure to meet the set target, there was progress on the negotiation front. A summit on negotiations for specific quantified agreements was held in Berlin in 1995 where a protocol was formulated in which industrialised nations stated their reduction commitment for the period 2008-2012 (Houghton, 2004). Basic structure and principles were set in Kyoto in 1997 but comprehensive details were agreed in 2001. The Kyoto protocol only came into effect in 2005 after the ratification of the treaty by Russia (Zedillo, 2007).

4.6.2 The Kyoto Protocol

The Kyoto protocol was ratified in 1997 and it came into force in 2005 with the aim of preventing dangerous interference with the climate system by limiting the emission of GHGs into the atmosphere (UNFCC 2008; Kyoto Protocol, 1997). Within the Protocol, countries are divided into groups namely Annex A (developing nations) with no specific mandatory requirements to reduce GHG emissions and Annex B (developed nations) which have mandatory requirements to reduce GHG emissions in the first phase of the protocol i.e. 2008-2012 (Kyoto Protocol, 1997). The Kyoto protocol controls emissions from six GHGs namely Carbon dioxide, Methane, Nitrous oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulphur hexafluoride (Ramaswamy et al., 2001). Basically under the protocol, emissions reductions are to be achieved through national measures but the protocol offers additional range of policies and options mainly through three markets based special mechanisms as follows:

Joint Implementation (JI): Allowed developed nations (Annex II countries) to implement projects that reduce emissions or increase removals by sinks. Article article 6.1 of the Protocol allows the transfer or acquisition of Emission Reduction units (ERUs) between Annex I states, which are also engaged in emissions trading. Examples included replacement of a coal-powered plant with a more efficient combined heat and power plant.

The Clean Development Mechanism (CDM): Allowed industrialised nations to implement projects that reduce emissions in developing countries e.g. rural electrification or reforestation of degraded lands. Article 12 of the protocol established the CDM to help Non Annexe I countries to achieve sustainable development and help Annexe I countries with alternatives to meet their targets. The CDM works by rewarding developing countries for their efforts in adopting low carbon emission strategies than they would otherwise. For instance if a country builds wind powered electricity from wind farms instead of coal powered plant to generate electricity then under the CDM it can convert the difference in potential carbon equivalent emissions between the coal plant and wind farm are calculated and converted into CDM after monitoring and certification of credits (formally called ‘‘Certified Emissions Reductions,’’ or CERs), then sold to industrialized nations seeking to purchase CERs under the Kyoto Protocol. Wara (2007) suggested that in theory the revenue generated can be used to build more wind farms.

Emissions Trading: Allowed industrialised countries to purchase ‘allocated amount units’ of emissions from other industrialised countries that find it easier to meet their targets. Thus Article 17 of the Kyoto protocol allows Annexe B countries to participate in emission trading for the purposes of meeting their commitments and that this should be supplemental to their domestic actions. The largest scheme so far is the EU ETS.

Besides the three mechanisms, the Kyoto protocol also recognises the use of carbon sinks i.e. forests and cultivated land to absorb carbon or off-set it in the atmosphere. Offsetting is however considered an ineffective option owing to the fact that comparing emission reductions across GHG emissions is scientifically contested and that involves huge costs (Wittneben and Kiyar, 2009). There is also an emphasis on the implementation of a compliance system to ensure effective implementation of the protocol. Boiral (2006) highlights that the protocol’s inclusion of a compliance system means that there must be a precise measurement and reporting criteria by parties involved.

The implementation of the Kyoto Protocol through the mechanisms is dependent on both country and private sector involvement. Kulovesi (2007) noted that it is through the

special mechanisms that the private sector plays an active role in the operationalisation of the protocol. Thus while states retain overall responsibility for compliance, the flexible mechanisms of the protocol accommodates participation of legal private entities. Under both CDM and JI, states are expected to approve the projects; appoint competent national authorities and authorise private entities to participate in the projects and trade credits. In addition, Boiral (2006) points to the emissions trading scheme as an area where private sector have taken a leading role more especially in the European GHG trading scheme which permits emitters to buy and sell emission credits depending on meeting prescribed emissions quotas. In fact Kolk et al. (2008) referred to the carbon trading scheme as a form of somewhat fragmented, decentralised carbon governance where various stakeholder interests like those of government, businesses, NGOs, key academic and professional establishments have converged.

Using its implementation mechanisms, the Kyoto protocol aimed at reducing emission by 5.2 per cent in the period 2008-2012 using 1990 levels (Grubb et al., 1999) and this is wholly the responsibility of Annexe B countries. Just like prior treaties the Kyoto was founded on the principle of 'common but differentiated responsibilities' which saw industrialised nations having differentiated reduction commitments while developing countries were excluded (Falkner et al., 2010). The justification of such a principle rests on the fact since the industrial revolution, developed nations are believed to be responsible for almost 70 per cent of carbon emissions while the developing nations are only responsible for less than a quarter (Stern, 2007). To promote international cooperation, the protocol also placed responsibility on industrialised nations to transfer financial resources to developing nations for climate change adaptability and mitigation. Under the protocol countries are encouraged to develop domestic measures and policies that help them achieve their targets and ensure sustainable development (Article 2 UN, 1998). Many consider the success of the protocol as being the first international attempt to lay down quantifiable targets for emission reductions (Falkner et al., 2010).

However the road to Kyoto ratification was characterised by a number of setbacks. Zedillo (2007) cites the unwillingness of the USA to be party to the treaty and the overgenerous terms offered to Russia as major drawbacks. The USA did not like the treaty's insistence on developed countries (Annexe I countries) having legally binding targets while excluding (Non-Annexe I countries) mostly developing countries whose emissions were projected to rise. Cost of compliance was also considered a burden to the growth of the USA

economy (Gupta 2010; Manne and Richels, 2004). Without the USA, the world's greatest emitter, the Kyoto protocol was deemed to fail.

Criticism for the Kyoto protocol was widespread. Prins and Rayner (2007) argued that the protocol was hastily assembled without much consideration to the peculiarities of climate change since it was simply modelled on previous treaty regimes like Ozone Depletion and Nuclear Arms Control which were wholly dependent on verifiable targets and timetables. Nordhaus (2007) stated that the protocol lacked effective enforcement action and had an inefficient allocation of emission rights and again did not attempt to link to any existing economic or environmental policies. Overall, Bosetti and Victor (2010) argued that from the beginning Kyoto was bound to fail due to varying political and developmental interests of countries who were to be party to the arrangement. Others point to its reliance on the goodwill of markets to solve the problem and letting countries set low targets as key catalysts for its ineffectiveness (Gupta, 2010). There is also some criticism to the flexible markets mechanisms within Kyoto as being a mere attempt to commoditise the earth's atmosphere which will lead to exchange of pollution at the expense of serious engagements in reducing emissions (Hepburn 2007; Lohmann, 2006). Sovacool and Brown (2009) specifically singled out the CDM mechanism as one that can be easily 'gamed' noting that by 2009, 300 projects had been approved of which more than half targeted one GHG i.e. Trifluoromethane and not carbon dioxide.

Notwithstanding the shortfalls, the implementation of the protocol went ahead under the leadership of the European Union which in 2005 established the first emission trading system. It went on to shape the climate agenda in Bali 2007 where the foundation of the Copenhagen 2009 was laid (Falkner et al., 2010).

The Kyoto protocol was originally going to expire on 1 January 2013, but was extended until 2020. During the second commitment period, Parties committed to reduce GHG emissions by at least 18% below 1990 levels in the eight-year period from 2013 to 2020. However, the second phase only covers about 15% of global emissions after Canada, Japan, New Zealand and Russia opted out (UN, 2012).

4.6.3 The Copenhagen Accord

With the Kyoto Protocol nearing expiry period, the international community focussed its attention on negotiating its replacement. The road map was drawn in Bali in 2007 with the

detailed protocol to be agreed upon in Copenhagen two years later. The Copenhagen Accord (2009) emphasised the need to hold mean temperatures below 2^{o}c and all major economies agreed to non-binding commitments to reduce emissions. Under the Accord, Annex I countries as categorised in Kyoto protocol are to state their targets while Non-annex I parties are to state their actions based on their own assessment of economic and political feasibility (Hufbauer and Kim, 2010). While making use of the Kyoto mechanisms the Copenhagen went further establishing principles for a system of international monitoring, reporting and verification. Financial resource pledges were also made to contribute towards developing economies programmes of mitigation and adaptation. The fund referred to as 'Green Fund' was to raise $100bn annually by having an initial capital injection from developed countries in form of reserve assets and thereafter to be completed by private sector participation by way of issuing low cost 'green bonds' in capital markets (Bredenkamp and Pattillo, 2010).

The outcome of the Copenhagen Accord was however deemed a failure by many climate change advocates pointing to its failure to set legally binding targets as a weakness (Falkner et al., 2010; Nordhaus, 2011). At the core of the disagreement was the same rationale as in Kyoto where industrialised nations were asked to make legally binding commitments whereas developing nations were insisting on being excluded and aided in mitigation and adaptation (Hufbauer and Kim, 2010). Others however were positive about the outcome of the accord pointing to its focus on the long term environmental goal and the green fund as useful basis for future negotiations (Doniger, 2009; Bodansky, 2010).

4.6.4 The Durban Platform

Following the disappointment of the Copenhagen summit, negotiations continued aimed at finding common ground on emission reductions leading to the Cancun agreement in Mexico 2010 of which details were to be agreed upon in Durban in 2011. According to UN (2011) the Durban summit saw 194 parties to the UNFCCC agreeing on a decision pack known as 'Durban platform' which among other things include measures to develop a legal binding protocol applicable to all members. More importantly the Durban platform extends the Kyoto Protocol and emphasise that a successor protocol be negotiated by 2015 to be implemented in 2020 (The UK House of Commons 2012). The Green climate fund agreed upon in the Copenhagen Accord was launched and a technology transfer mechanism to enable developing countries access clean, low carbon technologies was established alongside an adaptation committee.

Despite its ability to keep the debate of climate change alive, many analysts argued

the Durban Platform fell short of emphasis on preventing the global temperatures to rise by 2^{o}c (The Economist, 2011). Others argued that its lack of insisting of emission reduction targets now but rather delaying it to 2020 meant that the Durban had managed to usher a 'do nothing' era in as far as climate mitigation efforts were concerned (The Australian, 2011).

With seemingly minimal or no breakthrough in achieving international coordinated effort to fight global warming, there are signs that some nations are trying to ensure that the fight for global warming is not lost. For instance a group of six countries led by America (i.e. America, Brazil, Ghana, Bangladesh, Mexico and Sweden) have agreed for a five yearly plan to cut emissions of other GHGs (soot, methane, and hydrofluorocarbon) which have a shorter lifespan in the atmosphere than carbon dioxide but have strong impact on the amount of solar energy absorbed (The Economist, 2012). It is estimated that these GHGs contribute a third of the human related rise in global temperatures. The Scheme is called the Climate and Clean Air coalition to reduce Short Lived Climate pollutants. According to US State department (2012) cited Economist (2012), if successfully implemented the scheme is likely to slow global warming by 0.5^{o}C by 2050.

4.7 The UK Climate Change Policy Framework

The UK climate change policy framework recognises that much of global warming is anthropogenic and is a public good which requires policy intervention (Stern, 2006). The policy is premised on setting global trend in emission reduction and it also places emphasis on international cooperation (House of Commons Environmental Audit Committee, 2007). For instance, after committing itself to the Kyoto protocol and voluntary targets, it went on to champion climate change agenda when it took leadership of G8 in 2005 which led to the Gleneagles action plan on climate change in July 2005 which aimed at increasing the speed with which to reduce GHG emissions (The UK Climate change programme, 2006). The Stern Review (2006) commissioned by the government to carry out a comprehensive review of economic impact of climate change also helped shape policy direction of climate change policy worldwide (see Milne and Grunbic, 2011).

The policy direction has been evolving over time from a predominantly mitigating focus to one that also highlights the need for adaptation. The climate policy framework uses a mix of diverse policy instruments to achieve its objectives. Thus while the government champions market oriented policies through incentives that encourage innovations, prescriptive regulations are used where appropriate (DEFRA, 2007). The majority of mitigation policies target the energy carbon dioxide emissions which accounts for almost

four-fifths of total emissions in the UK (Bowen and Ridge, 2011). Based on the Stern Review (2006), the policy makes recognition that climate change is a public good and an externality but due to its uniqueness in that it is global and affects the poor more than the rich, the policy framework also contain elements of ethics and welfare.

The key element of the policy is to price externalities in a market friendly manner that encourages both firms and households to reduce emissions through consumption and production adjustment. Arguably the UK's main pricing instrument is the EU Cap and Trade Scheme which in 2009 covered 48 per cent of UK emissions (Bowen and Ridge, 2011). The EU Cap and Trade Scheme set quantifiable limits for emissions by firms from within its scope and the price is set by trading quotas. However there is criticism that the EU trading prices are too low to help reduce emissions and that volatilities in the trading price has created uncertainty in the private sector (Prado and Valor, 2007; Climate Change Committee 2009). Other sector specific regulations also exist like in the energy sector where labelling for energy efficiency products is a requirement meant to promote clean energy. In sectors not covered by the EU emission scheme policies have also been developed. For instance in the business and public sector which are considered as 'light industries' a range of policies like the Carbon Reduction Commitment, Building regulations and climate change levy are in place to assist organisation manage their emissions (Carbon Trust, 2012a). However the climax of the UK climate change policy is characterised by the Climate Change Act 2008 which gave legal force to domestic carbon reduction budgets. Following the Act, a Climate Committee is set responsible for assessing the prospects towards long term emission reduction targets and advising on the viable mitigation and adaptation policies (See section 4 for more discussion).

Below is Table 2 with an overview descriptions of some policy instruments used by the UK is its climate change policy

Policy Instrument	**Purpose**
Regulation	Design policies that set minimum standards e.ge emission limits or building standards
Fiscal Charge	Designing policies that price environmentally damaging goods e.g. environmental levies, charges, taxes.
Subsidy	Policies meant to reduce the price of environmentally friendly goods. E.g. lower VAT for energy efficient technologies
Market Creation	Policies that fix quantity e.g. GHG emissions or Renewable Electricity. Prices are determined by the market
Information provision	Policies that seek to enhance information to firms and consumers
Voluntary and Negotiated Agreements	Policies that encourage a firm or group of firms to make commitments to achieve a particular emission reduction target.

Source: DEFRA 2007. Synthesis of climate change policy appraisals. Available from: http://www.decc.gov.uk/assets/decc/what%20we%20do/global%20climate%20change%20and%20energy/tackling%20climate%20change/programme/synthesisccpolicy-appraisals.pdf.

In implementing the policy instruments, the government uses various initiatives and programmes which depending on their specific objectives uses an appropriate policy instrument to achieve the same.

4.8 The UK Climate Change Initiatives/Programs Implemented using the Policy Instruments

4.8.1 Climate Change policies prior to Kyoto Protocol

A number of initiatives were taken prior to the Kyoto protocol to help the UK reposition itself for carbon constrained future mainly in the energy sector. For instance, under the Electricity Act 1989, the Non Fossil Fuel obligation (NFFO) and the Scottish Renewables obligation (SRO) were established (Agnolucci, 2005). These were meant to support nuclear electricity

generation as a way of promoting clean energy and were funded by fossil fuel levy paid by suppliers of electricity from fossil fuels (Agnolucci, 2005). It should be noted, however, that these policies did not specifically target reducing emissions and that at this particular time the UK had no specific target to achieve in terms of GHG emission reductions. Nevertheless notable success was achieved by this program as the cost of electricity went down and the investment in Wind farms increased in the UK (Renewable UK, 2011). In 2002, these were replaced by the Renewables Obligation which was the primary renewable energy policy instrument (OFGEM, 2007). The emphasis of this policy was to encourage electricity end suppliers to purchase part of their annual electricity supply from producers using renewable technology and was meant to assist the government in achieving its GHG emissions targets under the Kyoto Protocol.

4.8.2 Climate Change Policies after Kyoto Commitments

4.8.2.1 The Climate Change Programme 2000

The UK made a commitment to cut emissions by 12.5 per cent by 2012 using 1990 levels under the Kyoto Protocol and it had its own voluntary target of reducing emissions by 20 per cent below the 1990 levels by 2010 (The UKCCP, 2006). In order to meet these targets the UK complimented its earlier initiatives by launching a climate change program in 2000 which contained measures to achieve the targets (de Muizon and Galachant, 2004). Wordsworth and Grubb (2003) highlighted that the program had two principal aims namely increasing investment in low carbon technologies and increasing government expenditure in promoting innovation in low energy techniques. The key instruments designed within the program were the climate change levy, the negotiated climate change agreements and the UK emission trading scheme (Smith and Swierzbinski, 2007: National Audit Office (NAO) (2007).

4.8.2.2 The Climate Change Levy (CCL)

The CCL, set out in FA 2000 budget and implemented in 2001 is a form of an environmental tax taking the form of a single-stage excise imposed to energy users in industry, the public, and agriculture at different rates depending on fuel type (NAO, 2007; Carbon Trust, 2012a). NAO (2007) explains that the aim of the Levy was to encourage businesses to use energy more efficiently and therefore to reduce GHG emissions from the levels they otherwise would have been. To encourage clean energy, exemptions are offered to energy generated

from good quality sources like fuels from waste, and for renewable energy sources like wind and solar power. The CCL is also designed to link to other instruments within the Climate change program like the climate change agreement. In this respect, firms in energy intensive sectors with a negotiated climate change agreement are eligible for an 80 per cent discount from the CCL (Pearce, 2005). This was reduced to 65 per cent in 2010. This is meant to encourage more firms to participate in the CCA which in turn provides more participants for the ETS (Smith and Swierzbinski, 2007). The CCL scheme managed to raise £0.7 billion in 2009 (Bowen and Ridge, 2011).

4.8.2.3 Climate Change Agreements

The CCAs are agreements negotiated between the sector industry organisations and the government through DEFRA in which firms take collective quantitative targets for improvements in carbon emissions in return for a 65 per cent discount in CCL. The agreements are two tiered in structure in that they specify obligations for the sector and then translate these into targets for individual firms. Enforcement action focuses on meeting both target and Failure to meet target is penalised by loss of the 80 per cent discount on CCL for 2 subsequent years (DETR, 2000). In the first year of compliance i.e. 2002, there were signs of over-compliance by participating firms which was either the fear for the penalties or low level targets which were deemed as 'business as usual targets' (Pearce, 2005).

4.8.2.4. The UK Emission Trading Scheme

The UK emission trading scheme was launched in 2002 with aim of providing flexibility for firms in meeting their GHG abatement obligations and also to position the UK in particular London as the global location for environmental location (Smith and Swierzbinski, 2007). The scheme covers the six GHGs as identified by Kyoto protocol and individual emission limits and the unit for trading are defined in tonnes of carbon dioxide equivalents. Firms participating are grouped into two: Direct Participants (DP) and Agreement Participants (AP). DP comprises the 32 firms which joined the scheme as a result of subsidy payments auction conducted by the government in 2002 (NAO, 2004). The subsidy was meant to incentivise the firms to offer abatement of their emissions in the period 2002-2006 against baseline emissions in 1998-2000. Specifically firms joining the auction were to commit to a specified level of abatement in 2006 and to make phased progress towards between 2002 and 2005 with 2002 target being 20 per cent of 2006 and then rising to 40 per cent, 60 per cent and 80

per cent in subsequent years (NAO, 2004). The DP are subject to a cap and trade system of emission trading where allowances equal to their baseline emissions are allocated, less the contracted abatement commitment for each year. Selling and buying of allowances was permitted in the ETS depending on whether abatement exceeded contracted level or not (Smith and Swierzbinski, 2007). The AP mainly referred to the firms that were covered by the CCAs. Under this category, firms can generate or sell allowances by exceeding their negotiated emission reduction targets or can comply by buying permits in place of abatement obligations. The participation was to be on voluntary basis but actual participation however depended on how firms had reacted to the CCL and CCAs.

Overall, the UK ETS was to some extent a success as most of the DP managed to meet the obligations. For instance DEFRA (2004) illustrated that within the first year the DP managed to exceed their abatement targets. NAO (2004) argued that the compliance of the DP was much to do with failings in efficiently allocating baseline emissions and not the firms' efforts. NAO (2004) noted that in some cases baseline emissions were above the emissions of participants at the start and this made it easy for them to meet the targets without further action. NAO (2004) further stated that in some cases the emissions reductions could still have been achieved without the program underscoring its observations that the targets were overgenerous. The scheme was later replaced by the European Union Emission Trading Scheme (EU ETS) in 2006.

4.8.2.5. The UK Climate Change Program 2006

The UK CCP 2006 replaced the UKCCP 2000 and it outlined policies and measures to help the UK cut its emissions and more importantly it also spelt out plans to adapt to the impact of climate change (UKCCP, 2006). The focus of the program was to help the UK meet both its Kyoto obligations and the domestic targets (DEFRA, 2006). The UKCCP 2006 also revised downwards the UK domestic targets from 20 per cent on 1990 levels in 2010 to between 15 and 18 per cent because earlier projections were deemed too optimistic and that available evidence showed that the government would not be able to meet the target (House of Commons environmental Audit Committee, 2007). Besides, NAO (2006) noted that the revisions were necessitated by inaccuracies emanating from projections modelling techniques which were complex and made it difficult to accurately determine the desired targets. There was however an emphasis of the UK plans to reduce emissions by 60 per cent by 2050 on 1990 levels.

Being a successor of UKCCP 2000, the UKCCP 2006 extended most of the policies

that were under its predecessor. For instance under energy use and supply, policies like the CCL, CCAs, and the Renewables obligations were extended. Other measures intended to improve energy efficiency use were introduced. Thus the Energy Efficiency Commitment (EEC) was introduced and it required energy suppliers to achieve energy savings through assisting the implementation of home energy efficiency improvements (Bowen and Ridge, 2011). Energy suppliers were also expected to make changes to appliance standards labelling, better metering, billing and improved customer information. Policies also covered other sectors like Agriculture and transport sector. In Agriculture there was emphasis in woodland planting and in transport there was the renewable transport fuel obligation where suppliers of fossil fuels were to ensure that a certain percentage of the UK road fuel supply was from renewable fuels (UNA UK, 2008). Nonetheless the two major policies that came with UKCCP 2006 were the RTFO and the EU ETS (DEFRA, 2007). The EU ETS was intended to help the government meet its domestic and international targets as it covers almost 50 per cent of carbon dioxide emissions (UKCCP 2006; UK House of Commons Environmental Audit Committee, 2007).

4.8.2.5.1. The European Union Emissions Trading System (EU ETS)

In the UK, the EU ETS replaced the UK ETS which was closed in 2006. The EU ETS is a key policy instrument used by the EU to achieve its Kyoto protocol obligation of ensuring an 8 per cent reduction in emission from 1990 levels (Carbon Trust, 2012b; Delbeke (ed.), 2006). It focuses on reducing GHGS and helping Europe build a low carbon economy in an economically and environmentally efficient manner (House of Commons, 2012). The scheme covers over 11,000 installations, including combustion plants, oil refineries, coke ovens, iron and steel plants, and factories making cement, glass, lime, brick, ceramics, pulp, and paper was implemented in three phases with the first largely being research and learning by doing and it run from 2005 to 2007 (Helpburn, 2007). The second phase covers the period 2008 to 2012 and includes revised monitoring and reporting rules, more stringent emissions caps and additional combustion sources. Thus in the second phase, member states proposed National Allocations Plans (NAPs) to the EU, allocating a set of the proportion of a country's total 2008 -2012 emission budget to sectors covered by the scheme and then tradable quotas were divided among firms (Bowen and Ridge, 2011).

The EU ETS works on a Cap and Trade principle meaning that there is a cap or limit on certain GHGs that can be emitted by firms and that within this cap companies can sell or buy allowances from another as needed (EU ETS, 2013). Annually firms are expected to have

enough allowances to cover their emissions or risk a penalty and those with spare allowances can be used against future emissions or sell them to others. At the end of phase two in 2012 the scheme will include emissions from Aviation. The third phase is expected to commence in 2013 when the scheme expands to cover emissions from petrochemicals, ammonia and aluminum industries. The third phase will run up to 2020 and some additions will include, harmonised allocation methodologies and additional GHGs and emission sources. The goal of the third phase is to achieve a 20 percent emission reduction by 2020 on 1990 levels. The EU ETS is arguably the largest in the world and it covers half of the EU emissions and by 2010 it was operational in 30 countries (EU ETS, 2013).

Generally a review of the first and second phases of the scheme seems to have mixed outcomes. The success of the first phase is unclear in as far reducing emissions is concerned because of data problems but Parker (2010) considers the ability to lay down structures for the subsequent phases as the real success of the this phase which helped place the EU on the path to Kyoto compliance. The second phase has however managed to help some countries achieve some success. For instance the UK reported a 23.3 percent reduction in GHG emissions of the six GHGs under the Kyoto protocol in 2010 from 1990 levels (DECC, 2012). This compares favorably to the domestic target of 20 percent reduction by 2010 (see Summerton, 2011) and hence it is on course to meeting its Kyoto obligation. The reported figures incorporate the net emissions achieved under the EU ETS. On the other hand, critics consider the EU ETS to be an underachiever citing its failure to efficiently allocate emissions while others also argue that the good intentions of the scheme were later watered down due to intense lobbying (Parker, 2010; Carrington, 2010). The EU acknowledged some of the weaknesses of the scheme and plans to eliminate the weaknesses during the third phase commencing in 2013 (Parker, 2010).

Under the EU ETS, there is monitoring system in which member states are required to report their progress in meeting the Kyoto protocol targets. Reports are expected to cover GHG emissions by source and removals by sinks (EU ETS, 2010).

4.8.2.5.2. The Climate Change Act 2008

After the launch of the UKCCP 2006, the UK demonstrated its seriousness in tackling climate change by giving a legal force to its targets and initiatives through the enactment of the Climate Change Act in 2008. The CCA 2008 is structured in five parts. The first part set a legally binding target of reducing emissions by 80 percent in 2050 from 1990 levels with the medium term goal being a reduction of 26/34 percent by 2020 or higher depending on global

deal (CCA 2008). In this part there is also requirement by the government to set five yearly carbon budgets and lay before parliament its policies to achieve the budgets. The principle of the 5 yearly carbon budgets commenced in 2009 when three budgets were set covering periods 2008-2012, 2013-2017, and 2018-2022. The fourth budget covering 2023-2027 was approved in 2011 (Bowen and Ridge, 2011). Requirements to outline a system of carbon accounting are also spelt out in this part. Arguably the budgeting system is the most innovative element of the CCA 2008 as it provides linkage to the other provisions of the Act notably on carbon accounting, reporting and monitoring. In part two, the key provision is the one that establishes a Climate Change Committee (CCC) responsible for helping the UK move towards a low carbon economy by assessing the prospects towards achieving the long-term emission targets and also to champion mitigation and adaptation policies (McGregor et al., 2011). Thus the CCCs main role is advising government of the technical issues of climate change and has no executive powers to ensure full implementation of its recommendation and some consider this as an institutional weakness of the current regime of climate change efforts (Stallworthy, 2009). It is the CCC that champions the task of drafting the carbon budgets.

The third part of the CCA 2008 empowers government to establish new trading schemes in the UK through secondary legislation. The schemes could be set by capping GHG emission from a particular sector or activity or encourage low carbon emitting activities. In this respect the Carbon Reduction Commitment Energy Efficiency Scheme (CRS EES) was established and it covers emissions by firms and public bodies not already subject to the EU ETS or other agreements. The main components of the scheme are the reporting requirements and a carbon levy (Bowen and Ridge, 2011) .The fourth part covers issues relating to impact of climate change and adaptation. Here regular reports regarding how the change in climate is impacting on UK should be provided as well as plans and programs to adapt to the changes. The last part of the CCA 2008 contains provisions covering a number of things ranging from reporting on, measuring and reducing carbon emissions in different sectors of the economy. The provisions also contain powers to introduce a waste reduction scheme, charges for single use carrier bags, and more importantly allows the government to consider introducing requirements for companies to report their emissions (CCA 2008). There is also requirement for the government to include emissions from Aviation and Shipping by 31 December 2012 or explain its failure to do so.

The CCA 2008 had set particular milestones in as far as emissions' reporting by

companies was concerned. It required government to publish guidance on the measurement of GHG emissions to assist companies reporting the same by 1 October 2009 (see Section 83 CCA 2008). Thereafter it demanded the government to review the contribution that reporting makes to emission reductions by 1st December 2010 (see Section 84) and then by 1 April 2014 to use powers in the Companies Act 2006 to make GHG reporting mandatory or explain to parliament its failure to do so (see section 85).

In compliance with section 83 of the CCA 2008, the government issued the DEFRA guidance on GHG emissions measurement and reporting in 2009. Thus in DEFRA 2009 specific measurement and reporting criteria on GHGs were outlined and the guidance was modeled from the GHG protocol and was also aligned to the ISO 14064-1 (DEFRA, 2009). In 2010 the government complied with section 84 of CCA 2008 and presented a report to parliament demonstrating how reporting contributes to a company's efforts in reducing emissions (DEFRA, 2010). There is no direct link between reporting and GHG emissions control but rather reporting is one policy that encourages firms to measure their emissions and it is measurement that has a direct impact on GHG emission control (DEFRA, 2010). It is in this respect that GHG disclosures are encouraged. Consultations are now in place as to whether the reporting should be made mandatory in compliance with section 85 of the CCA 2008.

4.9 Summary and Conclusion

The chapter has demonstrated that GHGs play a significant role in influencing the earth's climate system mainly by altering the solar radiation and exerting the greenhouse effect which help the earth maintain warmer temperatures suitable for life. Greenhouse effect is a natural phenomenon and is exerted by a number of gases notably water vapour and carbon dioxide. However over time through scientific research human influence was linked to the increased concentration of some GHGs notably carbon dioxide which as a result has been exerting more greenhouse effects than usual thereby making the earth much warmer. Carbon dioxide is singled out as a critical GHG because of its life span which is longer than the other GHGs. Examples of human activities that increased the levels of carbon dioxide in the atmosphere include the burning of fossil fuels, deforestation and cement production.

Global warming if unchecked, its consequences are dire and costly on both life and the economy on which day to day life has come to depend on (IPCC, 2007). Changes in temperature patterns are bound to change the way the earth sustain life. For instance global warming effects are likely to result in premature deaths, increases of diseases, displacement

of people and devastating effects on conditions on which most economic activities of mankind rely. In general the increase in global warming will mean a fundamental change in the way life is on earth and hence require substantial adjustment.

Despite the majority of the scientific community agreeing to the evidence that human induced global warming has occurred for the past 150 years, there is still some criticism of the science of global warming. Some point to too much reliance on proxies in estimating centuries old temperatures and projecting future temperatures which in their arguments undermine the integrity of the evidence. Others note the findings but argue that humanity has the ability to withstand any global warming that may occur. Notwithstanding the criticisms, public opinion and the verification of previous findings weighs the balance of argument in favour of the science behind global warming.

Faced with the reality of the devastating impact of a rise in global warming, the international community has been mobilising efforts to confront the dangers of global warming and limit GHG emissions. Being a public good and an externality with consequences likely to affect the poor more than the rich, there has been consensus that the best way to tackle climate change is through international cooperation with the rich bearing more burden of reduction than the poor. Early efforts are traced to the formation of the IPCC in 1988 as the scientific and policy research arm of the United Nations. With input from the IPCC, the UN negotiations have been taking shape aiming at reducing GHG emissions. This culminated into the Kyoto Protocol in 1997 which came into effect in 2005. The Kyoto protocol targeted a 5.2 per cent reduction in GHG emissions by 2012 from 1990 levels. Further negotiations followed after Kyoto protocol notably the Copenhagen Accord and the Durban platform.

Suffice to mention that international efforts so far have failed to reach consensus on the best option to fight global warming. Kyoto Protocol failed to have the support of all international players like the USA citing the mechanisms of the protocol that had favoured the poor and developing nations than the rich. They also complained of the high cost of compliance which would undermine their economies. Subsequent summits failed to reach consensus on the need to have a legally binding protocol largely because of the clause of 'common but differentiated responsibilities' which makes developed nations have legally binding targets while developing nations set their legal targets.

Notwithstanding the failures of the international efforts, there has been progress in ensuring that stakeholders notably corporations are taking measures in reducing their

emissions. Many point to the innovative mechanisms within the Kyoto protocol as the success story of the international efforts. They note that through the international efforts, carbon has been commoditised and has a price which gives firms incentives to participate in efforts meant at reducing emissions. It is also through mechanisms like Joint projects and CDM that the roles of the states and corporations have been clearly noted with each having their own responsibilities in the fight against global warming. With governments beginning to take a prominent role in shaping policy on global warming, firms have the right environment that is conducive to innovations towards a less carbon intensive technologies.

As international negotiations continue, there are some improvements being made to existing agreements which are meant to improve the accountability of the schemes. For instance under the Copenhagen Accord, an international system for reporting, monitoring and verification of GHG emissions was established. Arguably this suggests that principles of accounting and reporting will remain at the heart of any regime that might be operational at international level.

After brief review of the international policy framework for GHG management and control, the chapter then concentrated on the policy framework within the UK, the setting of the study. The UK climate change policy recognises that much of the global warming in recent times is due to human related activities as such there is an urgent need for action. Through the Stern Review (2006), the policy identifies climate change/global warming as a public good and an externality requiring government intervention. It also emphasises the need for international cooperation highlighting that climate change is a global problem requiring moblisation of all resources necessary. Means of intervention range from carbon pricing to some form of regulation and markets based measures like Emission trading.

Since the early 1990s, a number of initiatives have been implemented within the policy framework to help the UK achieve emission reduction targets. Long before championing the need for GHG emission reduction, measures introduced like the Non-fossil fuel obligation were meant to promote clean energy use. Once the need to control emissions became apparent i.e. after ratification of the Kyoto protocol, these measures and other additional measures like the climate change levy were part of comprehensive climate change programs meant to help the UK migrate to the low carbon economy. One of the most innovative market oriented measures brought by the climate change programs was the creation of the UK ETS scheme which was later replaced by the EU ETS. These schemes did not only mean that firms were accounting and reporting GHG emissions, they commoditised

carbon which meant more scrutiny behind the accounting and reporting mechanisms within the scheme. By use of the EU ETS and other measures within its climate change program, The UK was able to meet its 2010 domestic target for GHG emission target of 20 percent reduction by 2010 on 1990 levels.

The Results of more than a decade long initiatives in tackling climate change culminated into the enactment of the Climate change Act in 2008, making the UK, the first nation on earth to have legally binding targets. The Act committed the UK to ensuring an 80 percent GHG reduction by 2050 on 1990 levels while aiming at 34 percent reduction by 2030. The enactment of the Act brought in new dimension to the fight against global warming in the UK. Notably it established the Climate Change Committee and the system of formulating carbon budgets which would cement the seriousness of both current and subsequent governments in meeting the set targets. Another important element in the Act was the provision to ensure that a measurement and reporting guidance has been published by the government. The guidance was published in 2009 and the impact of measuring and reporting GHGs was assessed in 2010 in compliance with the provisions of the Act with a view of deciding whether GHG measurement and reporting should be mandatory or not. Such emphasis and intention arguably highlight one thing; Measurement and reporting of GHGs is of prime importance to the success of any policy framework developed to control emissions. However currently there is academic study that has investigated the extent of reporting by UK companies in light of the policy initiatives introduced. There has been surveys commissioned by both government and private institutions trying to bring insight into the GHG disclosure practices of companies in the UK in particular listed ones. However many studies and surveys have only concentrated on establishing the number of entities disclosing GHG information vis-a-vie their efforts to reduce the same (FTSE 350 Carbon Disclosure Report 2010; DEFRA, 2010) whereas no study has been undertaken to review what determines the extent and motivation of GHG information disclosure by these entities.

While it is appreciated that much research has been published testing a number of variables that help link a number of theories and explain the motivation of certain accounting disclosures other than GHGs, the majority of the studies have tested secondary data extracted from various sources like annual reports (see Cahan et al., 2005; Prencipe, 2004; Hanifa and Cooke, 2002; Ferguson et al 2002; Gray et al., 2001; Owusu-Ansa, 1999; Wallace and Naser, 1995; Hossain et al., 1995; Cooke 1993 etc.). Few have attempted to test primary data in order to explain the extent and motivation behind information disclosures (Bartlett and Jones,

1997; Adams, 2002). Therefore with this in mind it is necessary that a study be undertaken as to what determines the quantity of GHG information disclosed in the annual reports of these listed companies by testing both primary and secondary data. The findings of such research may help shape public policy since in accordance with the Climate Change Act 2008, a review as to the disclosure practices of the UK companies was undertaken in November 2010 with an aim of establishing linkage between GHGs disclosures and efforts to curb GHGs emission. Such evidence is deemed to exist indirectly and as such the government is contemplating introducing mandatory reporting in 2012 (DEFRA, 2010). The study to be undertaken on a longitudinal basis will also help track if public efforts through regulation like the DEFRA 2009 have helped increase the amount of disclosures over the period.

CHAPTER FIVE

Greenhouse Gas Reporting Framework in the United Kingdom

5.0 Introduction

The chapter analyses the financial reporting context in which Greenhouse Gases (GHGs) are measured and reported in the United Kingdom (UK). It is claimed by some researchers that reporting of GHG emissions is one of the key drivers influencing a firm to manage its emissions (DEFRA, 2010). The rationale for such a claim is that in business it is believed that what gets measured gets managed (Deloitte 2011; GHG Protocol, 2004). Reporting in form of GHG disclosures is also important to many stakeholders in particular investors who require a thorough review of business risks including climate change. Besides, governments/regulatory agencies are also interested in company reporting of GHG emissions as they strive to create a sustainable environment for a carbon constrained economy. This has created pressure on entities to report their GHGs both from the voluntary and regulatory perspectives. It is now estimated that there are over 100 voluntary and regulatory reporting initiatives world-wide (IPIECA, 2012). In return there is evidence that companies are now increasing their level of GHG reporting.

Notwithstanding the available reporting initiatives, climate change being relatively new, the reporting framework is arguably still in an evolving phase. Reporting guidance in the UK has largely remained voluntary though with a few emission schemes requiring participants to make certain disclosures. Therefore in this chapter the focus will be on what is there in the available guidelines to help firms make disclosures which are considered important in the management of GHG emissions. It begins by explaining how the reporting of GHGs has been developing in the UK from existing legal framework. Thereafter, available voluntary reporting frameworks within which companies can measure and report their GHGs are discussed. In this respect, initiatives like the GHG protocol; DEFRA guidance and the CDP are covered in detail followed by a summary of other schemes both international and local under which firms can be guided to report GHG emissions. The chapter then winds up by discussing the lack of consensus at the international level to issue an international reporting standard for GHGs which has potentially led to lack of harmonisation in reporting practices by firms.

5.1 GHG Measurement and Reporting Frameworks in the UK

In the accountancy profession through IASB, much attention and work has been directed at providing guidance on accounting for emission allowances leading to little attention paid to the measurement and reporting frameworks of GHGs to assist stakeholders decision making regarding carbon related assets and investments. Despite this, however, companies wishing to be transparent about their carbon emissions are not without guidance (KPMG Australia 2008). There are various international and national initiatives meant at providing guidance to carbon measurement and reporting like GHG protocol, ISO 14064-1, Global framework for carbon disclosure, Carbon Disclosure Standard Board, Etc.

In the UK, GHG measurement and reporting has been developing through both mandatory and voluntary initiatives. Mandatorily, it was arguably through the rise in prominence of environmental reporting that led to the significant evolution of GHG reporting. The genesis of environmental reporting is traced to Companies Act 2006 in particular S.417 which makes a provision on environmental reporting. Under this Act, quoted companies are required to report in their business review, environmental information and their related impact on the understanding of the business. Environmental risks, policies and KPIs should also be reported by listed companies. In order to assist companies meet the requirement of the Companies Act 2006, DEFRA (2006) issued guidelines for reporting environmental key indicators. In these environmental KPIs, companies are required to report on GHGs in particular total emissions as expressed in Co2e metric tonnes, GHGs covered etc. (DEFRA, 2006). There has, however, been criticism on the provision of the Companies Act (2006) to the effect that many consider it too general to adequately address GHG disclosure requirements and that managers were given too much discretion as to what to disclose (Williamson and Lynch-Wood, 2008).

The rise in prominence of climate change issues and policy framework has also seen the rise in efforts towards more mandatory reporting frameworks specifically for GHGs. The second phase of the UK climate change program (see Chapter 3) ushered in the Climate Change Act (2008) which in S.83 particularly required the government to issue reporting guidance on GHG emissions. This has been done through the issuance of DEFRA (2009) which stipulates voluntary guidelines on measurement and reporting GHGs. Other initiatives rolled out in the second climate change programme were various schemes like EU ETS (meant to promote emission trading) and CRC meant to promote emission trading for those not participating in EU ETS and discourage intensive energy usage. The monitoring of these

schemes is done on the premise of a set of reporting requirements which are mandatory. Furthermore, companies participating in EU ETS have been monitoring and reporting carbon dioxide emissions since 2005 whereas those involved in the Carbon Reduction Commitment Energy reduction scheme started reporting their emissions in 2010. The CRS covers over 5000 firms in the UK.

5.2 Mandatory GHG Reporting Schemes in the United Kingdom

5.2.1 The CRC Energy Efficiency Scheme

The CRC, which came into effect on 1 April 2010, is a mandatory scheme for non-energy intensive organisations in public and private sector with a threshold of 6000 MWh of annual energy usage (CRC, 2011). The first phase runs from April 2010 to 2013 and thereafter subsequent phases of 7 years each will follow up to 2043. Reporting is to be done on 31st March every year regardless of the financial year end. The scheme is enforced through an audit risk based approach where one in five companies is audited every year. The scheme intends to drive down energy usage by using three mechanisms namely: ensuring annual measurement and reporting of participants' energy consumption; trading of emission allowances sufficient to cover their emissions; and instituting reputational drivers through publishing of the league table for comparative performance assessment. More importantly, the scheme has civil and criminal penalties for non-compliance. Under the CRC, participants are required to submit a footprint report which summarises the energy supplied in the previous year. Primarily the report is meant to demonstrate that a company's emissions are covered by existing schemes i.e. EU ETS, CCA or CRC. The report is expected to cover: Core and residual energy supplies excluding those covered under EU ETS or CCAs; CCA exempt emissions as well as EU ETS emissions; quantity of electricity generating units eligible to claim credits; the supplies of other fuels to the organisation; and report any organisational changes likely to affect the footprint report (CRC, 2011).

Though disclosure is a mandatory requirement under the scheme, participants are given discretion as to what to disclose more particularly regarding the emission reduction measures. Accordingly, besides permitting limited disclosure on emission reduction measures, in some instances, the CRC permits non-disclosure of this information under confidentiality concerns. It is also not mandatory for reporting firms to externally publish their report. This then means that information disclosed under the scheme may vary greatly depending on how companies exercise the discretion thereby making comparison difficult.

Arguably the discretion aspect of the scheme makes it relevant to investigate what could possibly differentiate firm disclosures participating in this scheme.

5.2.2. The European Union Emission Trading Scheme (EU ETS)

The EU ETS, as noted (see Chapter 3) is regarded as an important scheme meant to help the UK meet both domestic and international emission reduction targets. Under the EU ETS, monitoring, reporting and verification activities are considered useful tenets in ensuring the integrity of the scheme. The reporting guidelines under the EU ETS, are legally binding. To begin with, participants to the scheme are expected to identify the installation and have them verified. Once this is done they are to disclose the verifier as well the installations under the scheme and the period to which the report relates. Disclosures should also be made when there are relevant changes in the operations of the installations including appropriate approvals to the same. Specific GHG disclosures include: Total emissions as expressed in metric tonnes Co2 equivalent; other gases emitted expressed in tonnes of Co2 equivalent; Methodology used in computation of data and emission factors chosen; and information on emission sources and streams (EU ETS, 2010).

Not much empirical study has been done to ensure the GHG reporting behaviour of firms participating in the scheme. However, the one done by Sales De Aguiar (2009) concluded that firms participating in the EU ETS had comparatively higher GHG emission disclosures than their counterparts which were not part of the scheme. This will be explored further in this study in order to ascertain whether belonging to such schemes as EU ETS has any impact on the quantity of GHG disclosures made by scheme participants.

5.3 Voluntary Reporting Frameworks

GHG emission voluntary reporting initiatives began to emerge in the early 2000s and were largely spearheaded by NGOs who aimed at providing either generic or industry specific guidelines (IPIECA, 2012). Such initiatives have led to availability of a wide range of reporting initiatives which have helped companies improve their GHG reporting. Notable frameworks include the GHG protocol (2004); The Global Framework for Climate Risk Disclosure (2006); The Carbon Disclosure Project (2012); The Carbon Disclosure Standard Board (2010); The Global Reporting Initiative (2006); PricewaterhouseCoopers Typico Co. illustration (2009); the DEFRA (2009); ISO 14064-1 and etc. All but DEFRA (2009) are as a result of private sector initiatives and partnerships meant at improving information available to stakeholders i.e. investors.

5.3.1 DEFRA 2009: Guidance on measuring and reporting GHGs

The DEFRA 2009 guidance on measuring and reporting GHGs was issued in compliance with Section 83 of the CCA 2008 and was aimed at supporting UK firms in reducing their contribution to climate change (DEFRA, 2009). The guidance is meant for firms of all sizes and it outlines how a firm can measure and set targets for GHG reduction.

The guidance is based on GHG Protocol which is an internationally recognised standard for corporate GHG accounting and reporting (DEFRA, 2009). Other measurement and reporting guidelines to which the DEFRA guidance aligns include (ISO) 14064-1, Publicly Available Standard (PAS) 2050 and ISO 14040 (DEFRA, 2009).

While setting the minimum benchmark the government expects firms to measure and report, the guidance is voluntary and it gives a step by step guidance on how an organization can master their GHGs control needs through measurement and reporting. Thus the fact that the guidance covers all GHG emissions of an organisation means that it helps an organisation have a complete picture of its GHG emissions unlike in other schemes like EU ETS or CRS where GHG measurement and reporting only covers certain aspects of the organisation. The guidance also encourages firms to set emission reduction targets and report on all gases as identified by the Kyoto Protocol.

The guidance is structured in 11 parts in which the process of measuring and reporting GHGs is explained and thereafter technical details are outlined in 11 annexes which range from A to K. According to DEFRA (2009) the process of measuring and reporting GHGs begins by identifying the appropriate ownership structure which will then highlight the appropriate category within which GHGs can be reported on. Thus in a complex organisation set up where a firm is not 100 per cent responsible for the emission activities, the guidance advises the use of either the equity approach (where an entity reports GHG emissions from operations according to its share in the operations) or the control approach (where an entity reports 100 per cent emissions in operations where it has control and does not report anything in operations where it has an interest but not control). Control can either be financial or operational but the guidance encourages the financial control approach.

Ultimately, GHG reporting follows similar financial reporting guidelines to organisation in that in cases where an organisation is part of a group, GHG emission reporting is to be done on a group basis as per ‘traditional’ accounting classification of the organisation’s operations. Generally the guidance attempts to highlight the fact that accounting for GHG emissions should overall follow the main stream accounting principles.

For instance, in Annex B emphasis is made that GHG emission information should follow accounting and reporting principles ranging from relevance, completeness, consistency, transparency, and accuracy. The aim of aligning GHG accounting and reporting to mainstream accounting framework is to ensure that reported information represents a faithful, true, and fair account of the company's GHG emissions (World Business Council for Sustainable Development/World Resources Institute, 2004). Alignment to existing accounting framework also helps to simplify the internal procedures of information preparation (OECD, 2010).There is nonetheless an omission of other important qualitative financial reporting attributes like comparability, reliability and understandability which makes some to question the GHG reporting frameworks alignment to the mainstream accounting. Such omission, argues Andrew and Cortese (2010), puts the value of information disclosed in question. Firms are also encouraged to report data on an annual basis as is the case in mainstream accounting. However, in the initial year firms are to choose a base year which is either the earliest year that verifiable emissions data is available or a multi-year average (see part 9 of DEFRA, 2009). The emphasis on the choice of base year is to ensure that progressively a firm reports data that can be comparable in terms of performance benchmarks (Sullivan and Gouldson 2012).

Once the organisational structure is appropriately defined, the guidance requires firms to identify their GHG emissions under three broad categories as follows:

- Scope 1 (Direct emissions): Activities owned or controlled by the firm that release emissions straight into the atmosphere. Examples include combustion in owned or controlled boilers, furnaces, vehicles, emissions from chemical production in owned or controlled process equipment.
- Scope 2 (Energy indirect): GHG emissions released into the atmosphere as a result of an organisation's consumption of purchased electricity, heat and cooling.
- Scope 3 (Other indirect): Emissions resulting from an organisation's actions, which occur at sources, not owned or controlled by it and cannot fall under scope 2. Examples include business travel by means not owned or controlled by the organisation, waste disposal etc.

The guidance specifically recommends reporting under either scope 1 or 2 and considers reporting under scope 3 as discretionary since scope 3 is deemed to be complex and difficult to accurately identify. But where an organisation's scope 3 activities are considered to be

significant then reporting is encouraged.

GHG emissions are determined by multiplying 'activity data' by 'emission factors'. Activity data is information collected about organisation's relevant activities and this could be litres of fuel consumed by an organization's fleet of vehicles which can be extracted in form of receipts or bills related to the activity. Firms are also permitted to use data collected in other schemes like EU ETS or CRC provided they are transparent regarding the calculation methods used and the emission factors adopted. Emission factors are provided by DEFRA and DECC and the standard measurement is tonnes of carbon dioxide equivalents. Any emission factors used and the calculation approach adopted are to be duly disclosed.

After activity identification and measurement, the guidance explains the general principles of disclosures of the GHG emissions data. Part 8 of the guidance advises firms to publish GHG emission data and supporting explanations and have the discretion to decide where this information is disclosed. Discretion is also left to individual organisation to decide whether to have their GHG emissions data verified by a third party or not. Under the DEFRA guidance there is no specification of the minimum level of reporting rather organisations are encouraged to ensure completeness in their reporting endeavours. It covers all the six Kyoto GHGs but disclosures of other non-Kyoto gases are encouraged. Detailed disclosure requirements by DEFRA (2009) can be found in Appendix 2.

The introduction of DEFRA (2009) guidelines is considered by many as a step in the right direction. Souza (2009) noted that such guidelines help companies find their way out in circumstances when they do not know how to do it. There has been evidence to the effect that some firms have found DEFRA (2009) useful. For instance Deloitte (2011) noted that 9 per cent of the firms on FTSE 100 were reporting GHG emissions based on DEFRA guidelines. There is, however, concern that being a voluntary document, comparison among firm/industry practices is difficult (CDP, 2011; Deloitte, 2011). The guidance has also some limitations ranging from being open to interpretations on reporting boundaries; limited scope 3 guidance; heavy reliance on GHG protocol for defining reporting boundaries; and limited guidance on materiality, benchmarking, and estimation of incomplete data (Environmental Resources Management, 2010). These shortfalls make comparability of data from firm to firm difficult. The guidance is also silent on corporate governance mechanisms relating to climate change and GHG emission management. Again despite encouraging firms to disclose targets and performance benchmarks like the intensity ratio, little guidance is given on target setting and performance assessment and companies are not required to disclose their likely

future projections of GHG emissions. For more information about what DEFRA (2009) requires to be disclosed in comparison to other reporting frameworks please refer to Table 3.

Despite the evidence as documented by Deloitte (2011) that firms, no known academic study has looked at the GHG reporting pattern of UK firms more especially at a time when the government has taken steps to highlight reporting as an essential element in a firm's GHG emission management. Arguably even the 'compliance or usage' rate in the Deloitte (2011) report is considerably low and hence may necessitate further review as to what form of reporting frameworks companies use in disclosing GHG emissions. More insights could be obtained when an investigation targets the impact the issuance of DEFRA (2009) had on the GHG reporting behaviours of firms as the same could be used to estimate the likely impact of the fully fledged regulation on GHG reporting.

5.3.2 The GHG Protocol

Apart from the DEFRA guidelines, firms in the UK can use the GHG protocol in their preparation of the GHG information. As explained, the DEFRA guidance was substantially derived from the GHG protocol. GHG protocol initiative was convened by WBI/WBCSD in 1998 to develop a set of internationally accepted GHG accounting and reporting standards for business (WBI/WBCSD 2004). The GHG Protocol Initiative is funded by the Alcoa Foundation, British Petroleum, The Energy Foundation (a coalition of philanthropists), The Hewlett Foundation (a private philanthropic endeavour), The Robertson Foundation (a private Philanthropic group committed to promoting market based solutions to climate change), the US Environmental Protection Agency, the US Agency for International Development (USAID), and the Wallace Global Fund (a private philanthropic fund). The GHG Protocol Corporate Standard was released in 2004 after rigorous testing of the first edition with structured feedback invited from companies including IKEA, Sony, Seattle City Lights, Eastman Kodak, Nike and Tokyo Gas. Further consultations were done with various firms and amendments were done. Though the process of consultation was comprehensive, many faulted its lack of proper representation from the accounting profession as only two professional firms joined and no academics were involved (Andrew and Cortese, 2010). Proper representation of key stakeholders is deemed important since formulation of standards is highly influenced by the participants.

The measurement and reporting criteria in GHG Protocol is as outlined in the DEFRA 2009 guidelines. According to the GHG protocol, reporting is expected to adhere to principles of complete, consistence, accuracy and transparency. The report is to be prepared

using the best data available with all material discrepancies identified. Before any disclosures are made, an organisation is required to define the organisation boundary within which the reported GHG emissions cover. This is done through the notion of control as explained in DEFRA (2009) above. The standard emphasises that when reporting, the contents should very much reflect the needs of the intended users. Where public availability of certain information say ratios threaten to undermine the confidentiality of the business, then the standard advises non-disclosure but that such information should be made available to those certifying the report. Reporting under the standard is in two forms namely recommended or optional. GHG Protocol disclosure requirements are detailed in appendix 3.

Though widely regarded as a leading standard for carbon with comprehensive but flexible approaches, GHG protocol has some shortfalls. For instance there is no linkage to any policy requirements and no attempt is made to provide guidance to small and medium enterprises (SMEs). Lack on minimum standards for materiality threshold and inability to stipulate verification requirements makes it inadequate to influence firms to produce comparable information (Environmental Resources Management, 2010).

5.3.3 The Carbon Disclosure Project

The CDP was formed in 2000 in the UK with the aim of collecting climate related data from firms for public consumption so as to enable investors have appropriate climate information in their decision making and help the responding firms manage climate related risks (CDP 2012). The CDP is funded by different organisations such as AXA, Merrill Lynch, Pictet Asset Management, PricewaterhouseCoopers, Standard Chartered, Environmental Protection Agency (US), DOEN Foundation (Netherlands), Esmée Fairbairn Foundation (UK), Oak Foundation (Switzerland), Nathan Cummings Foundation (USA) and the World Wildlife Fund (WWF) (UK, Germany and India) and it maintains that it is independent and not-for-profit. Nevertheless, some have expressed doubt to the claim of CDP independence arguing that though it is funded by various organisations, they are supposedly unified by one purpose which is to avert increased environmental legislation (Andrew and Cortese, 2010).

Unlike the DEFRA (2009) and the GHG Protocol (2004) which has prescribed tools on GHG calculation, categorisation and reporting, the CDP is largely a platform for firms to disclose GHG emissions and their actions in managing the same. Such being the case it encourages (but does not require) participants to use the GHG protocol. To gather data the

CDP sends out a questionnaire to companies worldwide and firms can respond voluntarily. Basically the questionnaire is structures in four parts (CDP, 2011). The first part captures a firm strategy in managing climate change risks and asks a firm to identify risks and opportunities from climate change including regulation, physical risks from extreme weather events, changes in technology and shifts in consumer attitude and demand. In this part a firm is also expected to disclose how it has integrated climate change issues into the business strategy. The second part concentrates on the governance mechanisms of a firm in having oversight on climate change issues. The third part requests a firm to detail out its accounting and reporting procedures/mechanisms of GHG information and state whether this information is verified. When reporting the GHG emissions in scopes, total emissions under Scope 3 are not required but rather a firm is required to disclose only relevant emissions under scope 3. The fourth part deals with information relating to firm's progress in achieving carbon reduction targets. When disclosing the emission reduction activities, a firm is required to state whether they are mandatory or voluntary. For more details of the disclosure requirements under CDP refer to table 3.

The first data request was sent in 2003 and 235 firms responded. Participation has been increasing and in 2009 the project had nearly 3000 participants covering over 60 countries (CDP, 2012). By early 2012, some 655 institutional investors were working with CDP representing US$78 Trillion in assets, an increase from just 35 in 2003 (CDP, 2012). In contrast, the response rate and quality of responses has been disappointing. Andrew and Cortese (2010) noted that there was generally low response rate and that in most cases firms were returning incomplete responses and opting for anonymity. Inconsistency in data preparation was common and this made comparability impossible. This could be attributed to the fact that despite recommending GHG protocol as the basis for their data preparation, the CDP allows firms to choose their own guidance. The CDP has, however, been improving the quality of the responses by standardising the reporting requirements with a view of encouraging comparability. Part of the improvements made in 2007 was to request firms to be disclosing their methodologies (CDP 2007).

Despite its shortfalls, CDP has had significant influence on GHG disclosure behaviour of firms in the United Kingdom. Okereke (2007) mentioned that Schemes like CDP managed to influence top UK corporate companies to begin to disclose GHG data. Since the CDP was launched, firms mostly in FTSE 350 have been active participants and in 2008 they had a 68 per cent response rate and 22 per cent of firms in Global 500 Carbon Disclosure Leadership

Index were from FTSE 350 (CDP FTSE 350, 2008). In 2011, 236 firms of the FTSE 350 responded to the CDP questionnaire and 79 of the respondents indicated that they had managed to reduce GHG emissions by implementing specific measures in the prior year (CDP FTSE 350, 2011). Due to lack of standardised guidelines, CDP data disclosed by FTSE 350 are often inconsistent and incomparable (CDP FTSE 350, 2011). Some have criticised the open ended nature of the question in CDP which means more discretion to reporting companies but then difficult to obtain easily comparable data (Sullivan, 2006).

5.3.4 ISO 14064-1: Specification for measurement and reporting GHGs at organisational level

The standard was first released in 2006 and is divided is divided into three parts namely:

Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements

Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions

Therefore it is ISO 14064 part 1 that primarily guides the GHG reporting at company level. However the standard is fundamentally dependent on the principles and concepts outlined in GHG protocol. The standard encourages organisations to prepare a GHG report to facilitate GHG inventory verification, and a firm's participation in various GHG programs as well as informing external users. While reports are expected to be complete, consistent, accurate, relevant and transparent, the organisation has the discretion to determine the structure, content and dissemination methods of the report depending on its needs. Where an organisation claims conformance to ISO 14064-1 then it is required to make available a report compiled according to the specification of this standard and where possible a verification report to that effect (ISO 14064-1, 2006).

The disclosure requirements in ISO 14064-1 are in most respects similar to those required under the GHG protocol albeit with minor variations. ISO 14064-1 has a total of 29 reporting requirements compared to 27 under the GHG protocol. Both standards categorise the requirements as mandatory and optional. Of the 19 mandatory requirements under ISO 14064-1, only five are not included in the 18 mandatory requirements under GHG protocol and these are; Organisation description; authorship of report; separate quantification of

removals; quantified internal projects; statement as to compliance with ISO 14064-1; and statement as to whether the emissions have been verified. A total of 10 optional disclosures are needed under ISO 14064-1 against nine in GHG protocol of which 5 are not in GHG protocol as follows: Company mission statement; disclosure of schemes to which a firm belongs; planning information; monitoring procedures; statement from the Chief Executive Officer. One notable omission under ISO 14064-1 is that there is no mention of the need to report on Non-Kyoto Gases which might then suggest that disclosures under the standard might be incomplete.

5.3.5 The Climate Disclosure Standards Board (CDSB 2010)

The CDSB disclosure framework is designed to assist firms disclose climate change information that is relevant to investors. In this respect, the CDSB (2010) encourages firms to disclose information that lead to understanding of the impact of climate change on business objectives and strategy, and the organisational performance. The disclosure requirements are also aligned to requirements specified in other initiatives like CDP, WRI GHG protocol, ISO 14064-1, CERES October 2006 Global Framework for Climate Risk Disclosure, GRI –G3 Guidelines, and the US SEC's 2010 interpretive guidance on disclosure of climate risk. Thus apart from disclosures of quantified GHG emission data as prescribed in other disclosure frameworks like GHG protocol and ISO 14064-1, the CDSB also emphasises disclosure on strategic analysis, risk and governance of climate change. In this respect management must outline the impact of climate change on operational and strategic strategies and the governance processes to mitigating the same. Risks and opportunities arising from climate change should be clearly identified and reported. The GHG management plans should set out clear targets and timelines and duly disclosed together with information on the emission schemes to which a firm belongs (CDSB, 2010). Refer to appendix 4 for a detailed disclosure requirements of CDSB 2010.

5.3.6 Global Framework for Climate Risk Disclosure (GFCRD, 2006)

This framework was initiated in 2005 and launched in 2006 to help improve corporate disclosure of climate change risks and opportunities and is applicable to all companies (GFCRD, 2006). It encourages standardised climate risk disclosures which are easy for companies to prepare and investors to follow. The framework is not a new reporting mechanism as such companies using it are encouraged to ensure that they continue to follow existing reporting mechanisms like CDP, Global Reporting Initiative, etc. Companies using

the framework are expected to disclose climate change information in the following four categories: Emissions disclosure; Strategic analysis of climate risk and emission management; Regulatory risks; Physical risks. Disclosures under these headings are quite similar to those provided for in other reporting frameworks save for the fact that the Global Framework is quite detailed on the particular risks to be disclosed.

Thus under physical risks, a firm is expected to disclose how climate change has affected business operations including supply chain and actions/strategies taken to adapt to these risks. These effects could be weather patterns, sea level rise, water availability and hydrological effects etc. Disclosure of regulatory risks are to include any known trends, events, demands, commitments, and uncertainties stemming from climate change that are reasonably likely to have a material effect on financial condition or operating performance. This analysis should include consideration of secondary effects of regulation such as increased energy and transportation costs. The analysis should incorporate the possibility that consumer demand may shift sharply due to changes in domestic and international energy markets; all GHG regulations applicable in the country in which the firm operates and where possible their impact on company operations; The company's estimate of future cost of carbon under various scenarios of reductions (GFCRD, 2006). The scenarios to incorporate assumptions as envisaged in GHG regulations. Disclosure of future scenarios is hailed as being unique and important in helping investors make investment decisions in relation to the projected scenarios (Sullivan, 2006).

5.3.7 The Global Reporting Initiative Guidelines for GHGs

The GRI is a non-profit organisation formed in 1997 and it develops and publishes guidelines for sustainability reporting including environment and GHG in particular (GRI, 2013). The guidelines, which were first published in 2000, revised in 2002 and were further reviewed in 2006 (this version is referred to as the third generation G3), are developed through multi-stakeholder consultative process. Overall, the GRI reporting framework provides principles and guidance for standard disclosures on strategy, an organisational profile, report parameters, governance, a 'management approach' description and performance indicators (comparable information on the economic, environmental, and social performance) (Kraal, 2012). The GRI based reports are expected to be complete, consistent and a reflection of the economic reality of the organisation with due consideration for relevant stakeholders. Accuracy and timeliness of the reports are also emphasised as they are crucial to stakeholder assessment.

Under the GRI 3, there are a total of 79 performance indicators expected to be disclosed some of which are quantitative while other are qualitative (GRI, 2006). Fifty of these indicators are considered core depending on their perceived usefulness to stakeholders as such are expected to be prioritised in the disclosures (GRI, 2006). Organisations using the framework are expected to disclose their reporting range which is categorised from C through A+ and this removes the need for self-declaration that the organisation is reporting using GRI framework as was the case in GRI 2. The guidelines for climate change disclosures are included under the environmental performance section of the document. Thus indicators EN1-EN30 relates to environmental disclosures but it under EN16 to EN18 where specific disclosures for GHG emissions are specified. These disclosures are: EN16: Total direct and indirect greenhouse gas emissions by weight; EN17: Other relevant indirect greenhouse gas emissions by weight; EN18: Initiatives to reduce GHG emissions and reductions achieved.

The reporting guidelines in GRI are applicable to all organisations regardless of size, location or sector. Though voluntary, usage of the guidelines has been gradually increasing. A KPMG survey of 2008 on G250 by revenue from 22 different countries found that almost 75 per cent of the companies were using GRI guidelines in their sustainability reporting (Sherman, 2009). Again by 2009, almost 1300 organisations worldwide published a GRI based report (GRI, 2013). Despite its supposedly wide usage, GRI guidelines have been criticised as being too general and not very suitable for some specific sectors and GRI has responded to these concerns by introducing sector specific standards for sectors like financial services, transportation and logistics etc. (Sherman, 2009).

5.3.8 Other GHG Reporting Frameworks

In addition to the frameworks discussed above, there are further guidelines issued by various bodies which can be used by a firm disclosing GHG emissions. For instance in trying to help firms use available measurement and reporting guidelines, PwC (2009) developed a template/model specifying the kind of disclosures that can improve carbon transparency and accountability in a firm. The model was aimed at demonstrating how companies can incorporate GHG emission data and strategy into their overall business strategy. It also managed to show linkages between GHG information and the financial performance indicators of a firm. Through the model, it is suggested that disclosed information should cover the following: company background and the purpose of the report; the company's climate change strategy; Impact of climate change on business; prevailing environmental and

regulatory governance on the company; analysis of financial performance in relation to climate change; directors responsibility of approval of environmental strategy; primary statement of GHG emission for the company with comparable data in the reporting period; and an assurance statement (PwC, 2009). Both quantitative and qualitative disclosures are demonstrated through the model.

There are other guidelines like the Publicly Available Standard (PAS 2060) and DECC Carbon Neutral guidance which aim at helping companies claim their carbon neutrality. The PAS (2060) was developed by the British Standard Institution (BSI) to provide best practice guide as to how a company can achieve carbon neutrality. The standard set measures and requirements for companies to demonstrate carbon neutrality for their products and services. For measurement the PAS 2060 encourages firms to use GHG protocol, ISO 14064-1, and PAS 2050. It requires measurement of all Scope 1 and 2 and Scope 3 emission which makes 1 per cent of total footprint. After measurement, the standard requires an entity to draw up a public commitment plan to reduce emissions. The plan is to contain the following: a time scale, specific targets for reductions, the planned means of achieving reductions and how residual emissions will be off. Offsetting should only be done with highly certified carbon credits. The standard requires public disclosure of documentation used to claim carbon neutrality as a way of promoting transparency.

Again, the DECC Carbon Neutral guidance which was issued in September 2009, also aimed at improving the transparency on organisations claiming carbon neutrality. The guidance mainly outlines how a company can calculate emissions, what constitutes and how to report emission reductions and carbon offsetting. The guidance does not set out measurement criteria and instead encourages companies to use existing standards for methodology. For instance, when claiming carbon neutrality for products, the guidance advises companies to use either PAS 2050 or ISO 14040. Apart from disclosures on GHG emissions as required in other frameworks, the guidance emphasises on the disclosure of the activities that leads to offset of carbon emissions and impact. Consequently, companies are expected to disclose the following: time period to which the carbon neutral claim relates; Information on how carbon neutrality has been verified including type and subject of verification (if no verification is done then an explanation for not been carried out); state the reduction measurement (absolute or intensity) and justify the choice and the state time period to which the reductions relate; reduction activities undertaken; the amount of off-sets purchased with clearly identifiable supplier and quantification methodology; and disclosure

of how off-sets projects were validated and verified i.e. the quality criteria should be stated.

For a detailed overview of the disclosure requirements under various reporting frameworks, refer to table 3 below.

Table 3. Disclosure Requirements as stipulated in various Reporting Frameworks

Disclosures\Frameworks	ISO 14064-1	PwC 2009	Carbon Disclosure Standards Board (CDSB 2010)	Global Framework for Climate Risk Disclosure (2006)	Global Reporting Initiative (GRI G3)	World Resource Institute/ GHG Protocol (2004)	Department of Environment, Food and Rural Affairs (DEFRA 2009)	The Carbon Disclosure Project (CDP)	DECC Carbon neutral guidance (2009)	The EU ETS	The CRC Energy Efficiency Scheme
GHG Emission: General											
Institutional background and period covered by report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total GHG emissions in Co2 metric tonnes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Scope 1 emissions	✓	✓	✓	✓	✓	✓	✓	✓			
Scope 2 emissions	✓	✓	✓	✓	✓	✓	✓	✓			✓
Scope 3 emissions				✓		✓	✓	✓			
Organisational Boundary/consolidation approach	✓	✓				✓	✓				
GHG emission targets set and achieved	✓		✓			✓	✓				✓
Historical comparative data	✓	✓	✓	✓		✓	✓	✓			
Base Year	✓	✓	✓			✓	✓	✓			
GHGs covered		✓	✓			✓		✓			
Sources and sinks used/excluded	✓	✓	✓		✓	✓	✓	✓		✓	
GHG emission performance ratios e.g. Intensity ratio							✓				

Conversion factors used	✓	✓					✓	✓		✓	
Regulated Schemes to which a firm belongs		✓	✓	✓							✓
Reporting Guidelines used in reporting	✓	✓	✓		✓		✓	✓		✓	
An assurance statement on disclosed information	✓	✓			✓	✓	✓		✓		
Strategic Analysis											
Statement on company position on climate change and related responsibilities		✓	✓	✓				✓			
Actions/measures taken to reduce/mitigate climate change impact	✓	✓	✓	✓	✓	✓		✓		✓	
Corporate governance on climate change	✓	✓	✓	✓	✓			✓			
Incentives available to executive management on Climate change				✓							
Climate change opportunities and company strategies		✓	✓	✓	✓		✓	✓			
Risk Analysis											
Climate change impact on business operations including supply chains		✓	✓	✓	✓		✓	✓			
Adaptation strategies to climate change effects				✓				✓			
Regulatory risks as a result of climate change		✓	✓	✓	✓		✓	✓			

Future Scenario analysis incorporating provisions of the law or potential regulations				✓	✓						

Table 3 demonstrates wide availability of a number of GHG measurement and reporting frameworks. The underlying principles of accounting and reporting frameworks of these voluntary initiatives have largely remained common targeting the GHGs identified under the Kyoto protocol and an emphasis on reporting on GHGs primarily in two scopes. Thus, from the table it can be seen that though information disclosure requirements differ from one framework to the other, overall there are commonalities in what companies are expected to disclose on climate change. Generally companies are expected to disclose the governance and management structures in place for climate change; assessment of the impact of climate change on the business; risks and opportunities arising from climate change; and company's strategies/targets and actions meant to reduce/control emissions. Specific disclosures relating to GHGs include: total GHG emissions expressed in metric tonnes of Co2; measurement criteria and emission factors used; scope of reporting; and a statement to whether the data has been verified. The other similarity in the frameworks is that they are generic and are applicable to all sectors. This is, however, a concern in that such lack of specific sector considerations makes it difficult for investors to have a meaningful comparison or performance benchmarks to assess companies (Sullivan and Gouldson, 2012).

However, from above, it is evident that very few frameworks place emphasis on forward looking information rather most emphasise on historical data. Only the Global Framework for climate Risk Disclosures (GFCRD, 2006) and GRI G3 require incorporation of likely future scenarios in their climate risk analysis. Such information is deemed useful in decision making. The backward looking nature of the guidelines makes them inadequate to meet some investor needs which are concerned about the future (Sullivan, 2006). There is also no emphasis on quality or indicators that might encourage quality of the disclosures which again undermines the decision usefulness of the disclosed information.

In practice companies appear to use the frameworks in their GHG preparation reports. For instance Sullivan and Gouldson (2012) researching on how the retail sector in the UK report GHG emission found that six of the nine retailers studied were claiming/using GHG protocol. In addition, Deloitte (2011) also found that 9 per cent of FTSE 100 was using the DEFRA 2009 guidance. However, no academic study has provided evidence as to the extent of GHG reporting influenced by these voluntary reporting initiatives. It is also not known whether the introduction of DEFRA (2009) made a significant contribution to the GHG reporting pattern of firms in the UK.

5.4 International Financial Reporting Standards and GHGs Reporting

Despite the numerous voluntary guidelines on GHGs reporting, there is generally consensus on quantification and level GHG information disclosures. In the UK, firms using either DEFRA (2009) guidance or the GHG protocol are likely to quantify and disclose GHGs in a similar manner since the former was modelled on the latter. Besides, as explained most reporting frameworks do not prescribe their own measurement criteria instead they encourage firms to use the GHG protocol for guidance. Nonetheless, there is no GHG reporting guidance from International Accounting Standard Board (IASB). Depending on classification as to asset or liability form, GHG can be reported within the bounds of the current IASB reporting standards (Barbu et al., 2012). The IFRSs mostly applicable to environmental and GHGs are those covering valuations, provisions, transparency and presentation (ICAEW, 2009). For instance under IAS 1 a company is expected to make reasonable judgement as to what information is to be presented and disclosed in the financial statements with due consideration to the decision usefulness of such information to stakeholders. In this respect a company is supposed to disclose all environmental and social information which would help stakeholders form an overall picture of the company. Generally just like any other accounting information disclosure, environmental and GHG disclosures under IFRS are expected to be guided by materiality and substance over form principles. Thus under materiality concept, size, nature and circumstances of the subject in question determines what is to be disclosed. Substance over form in relation to GHG emissions means that disclosures among other things will be made based on whether GHG emissions lead to new assets or liabilities.

Notwithstanding the fact that most GHG emission disclosures can fall within existing IASB standards, there is generally a lack of consensus/guidance on how to account and report GHG emission allowances brought by innovative schemes like those in Kyoto protocol or the EU ETS. In addition, categorising a carbon sink or source (identified within the framework of the Kyoto protocol) as either an asset or liability is also not a straight forward criterion (Ratnatunga, 2007). A number of surveys and studies on the financial statements of firms participating in say the EU ETS have revealed diversity of emission allowance accounting and reporting practices being used by firms (Lovell et al., 2010; PwC and IETA, 2007). This is attributed to lack of a generally accepted international reporting standard for GHGs for the treatment of the emission allowances (Guenther and Stechemesser, 2011). Ratnatunga (2007) argued that the current accounting framework is ill equipped to meet the information challenges of global warming noting that even though monetary quantifiable unites are

assigned to carbon or other gases, the question of how to account them in the assets and liabilities framework is still unanswered. Lack of common accounting methodology for firms participating in the EU ETS is of concern as it undermines the effectiveness of the emission markets itself whose valuation and re-evaluation is dependent on accounting criteria (Lovell et al., 2010).

The operation of the EU ETS is what calls for thoughtful accounting practice. In the first phase of the EU ETS, emission allowances were allocated freely and this either meant a nil value in the accounts if the cost basis is adopted or other if the market value approach is considered. Once the allowances were allocated, the focus shifted to the valuation of the allowances being sold or purchased by firms for various reasons in a bid to control their emissions. Often trading on the allowances was characterised by huge volatilities which for instance in between 2008 and 2010, the price had fallen from 28 Euros to 8 Euros hence necessitating accounting practices that reflect the underlying forces of the market. Subsequent allowances under the EU ETS phases two and three which commences in 2013 and 2020 respectively will be auctioned meaning a fundamental change in the way emission allowances can be accounted for. Other areas also exist where accounting guidance is needed. For instance accounting for allowances and obligations where there is no active market and how should intermediaries like brokers and other position taking institutions not subjected to caps account for their operations (Ratnatunga, 2007).

Firms participating the EU ETS and are listed on the FTSE 350 are required to prepare financial statements based on International Financial Reporting Standards (Deloitte, 2012). This then means that their reporting GHG emission allowances should be in line with the guidance as provided by the International Accounting Standards Board (IASB). However, to date IASB has issued no guidance on how firms should account for emission allowances. Earlier, an attempt was made to issue accounting guidance for EU ETS emission allowances through *International Financial Reporting Interpretations Committee (IFRIC) 3: emission rights*. IFRIC 3 recommended that the EU allowances (Assets) should be treated independent of the liabilities arising under the EU ETS meaning that liabilities could not be measured on the carrying amount of the underlying assets. Under IFRIC 3, emission allowances were to be categorised as intangible assets hence falling under the accounting treatment stipulated in IAS 38. Fair value was recommended as the accounting methodology of determining the values hence allowances were to be measured at fair value initially with the difference between the amount paid for and fair value identified as government grant under IAS 20. The grant was to

be classified as deferred income in the balance sheet and subsequently recognised as income over the compliance period. Regarding liabilities IFRIC 3 stated that they should recognised at market value as provision under IAS 37 in the accounts as allowances are made (Deloitte, 2007).

The IFRIC 3 did not see the light of the day as it was withdrawn due to widespread criticisms. Lovell et al. (2010) explains that the controversy rested on IFRIC 3 recommendation that gains and losses derived from the valuation of liabilities be reported in income statement, while the gains and losses from any valuation of emission allowances were to be treated under equity in balance sheet. With IFRIC 3 there was clearly a mismatch in how different assets could be treated and this led to the criticisms (Ratnatunga, 2007; Mackenzie, 2009).

With the withdrawal of IFRIC, firms in the EU ETS have no official guidance on accounting for emission allowances. Therefore in the absence of the guidance, firms are expected to follow paragraph 10 of IAS 8: Accounting policies, Changes in Accounting Estimates and Errors which gives management discretion on accounting principles to be followed in consultation with their auditors in situations where there is no guidance. Such a vacuum, as noted by Lovell et al. (2010) has led to array of accounting standards being used in accounting for emission allowances. Other surveys have also confirmed diversity in the Accounting practices for GHG emission allowances (see PwC and IETA, 2007; Mcgready, 2008).

Going forward, the IASB is corroborating with the Financial Accounting Standards Board (FASB) of the USA to come up with a joint accounting criteria for emission allowances (FASB, 2010). Lovell et al. (2010) noted that the IASB/FASB joint project is a wider initiative to cover all emission allowances but no substantial progress is being made due to fundamental differences in traditional accounting cultures between the two bodies.

5.5 Summary and Conclusion

The chapter discussed a number of reporting frameworks which can be used to disclose GHG emission information in the United Kingdom. It began by highlighting the fact that though reporting is one important factor in helping a firm manage its emission and forms the basis of accountability and transparency in emission trading schemes, there are largely no mandatory requirements for firms not belonging to any scheme to disclose their emissions. Firms belonging to emission trading schemes like EU ETS and CRC have a set of minimum mandatory requirements for GHG disclosures. In addition, Companies Act 2006 requires

companies are to disclose environmental information which includes GHG emissions. Despite this, there are numerous voluntary reporting frameworks which firms can use for the GHG reporting requirements. Therefore the GHG reporting practices in the UK can be described as a mixed of both mandatory and voluntary regimes. Thus in compliance with the Companies Act 2006, and in particular DEFRA (2009) guidance, companies can disclose their GHG emissions which includes total emissions as expressed in metric tonnes of Co2 equivalents and the types of GHGs covered. Similar information is to be disclosed by companies participating in EU ETS. Companies under the CRC scheme are required to give detailed disclosures on GHG emissions and other disclosures regarding energy usage and suppliers and any non-compliance is either a civil or a criminal offence. While the schemes prescribe disclosure requirements, much of the disclosures and measurement criteria are drawn from various voluntary reporting frameworks notably the GHG Protocol (2004).

A number of voluntary reporting frameworks are available which can be used by companies in making GHG disclosures. These include the GHG Protocol, CDSB, ISO14064-1; DEFRA (2009), CDP (2012), PwC Typico Illustration (2009), etc. DEFRA (2009) guidance which came as a result of the CCA 2008 ushered in a new era in the measurement and reporting of GHGs in the UK in that for the first time firms were provided with a formal guidance on measuring and reporting their GHG emissions. DEFRA (2009) was modelled on the GHG protocol which is considered as the 'generally accepted standard for carbon measurement and reporting' worldwide. Under DEFRA, firms are to calculate emissions from activities falling under their control. Once this is properly identified then carbon should be categorised in three scopes with measurement being done multiplying activity data by emission factors as provided by the authorities from time to time. The DEFRA (2009) guidance is voluntary as such firms are not compelled to follow it. The guidance, in recognition of its dependency on the GHG protocol also recommends that firms can measure and report based on the GHG protocol.

It should be noted however that even prior to the DEFRA guidance, firms in the UK had been participating in other voluntary schemes meant at encouraging firms to control their emissions. One such scheme is the CDP which was launched by a group of institutional investors who realised that with no international consensus on how GHG emissions should accounted for, many stakeholders could risk having incomplete information in their decision making. Since the CDP is barely a reporting mechanism meant to improve transparency and accountability, it does not have its own criteria on how firms should measure GHGs and

instead it encourages firms to use the GHG protocol. The lack of having a single standard with which firms can use to measure GHGs has meant that comparability of accounts is unattainable which suggests that GHG information, in as far as other stakeholders are concerned, does not meet the criteria of quality accounting information.

Under the available guidance, companies are required to measure their carbon footprint before any disclosures are made. Both direct and indirect footprints should be measured and then the organisation should disclose total emissions expressed in Co2e tonnes and the measurement criteria/standard used. Once measurement is done and disclosed then the organisation is required to carry out a strategic analysis of the carbon emission which will lead to disclosure of actions taken to reduce emissions, corporate governance processes instituted to manage the emissions. Disclosures under strategic analysis should clearly identify the opportunities available in carbon emission management e.g. emissions trading schemes. Finally the guidelines stipulate the need to make carbon related risk disclosures. At a minimum the risks should either be physical risks i.e. the impact of climate change on company operations and regulatory risks e.g. the impact regulation of carbon could have on company operations. In as far as there are commonalities in the disclosures, there are also common shortfalls in the reporting frameworks notably the fact that they are mostly backward looking and generic which then limits their usefulness in decision making.

Currently there is no specific international accounting standard for GHG emissions. GHG emissions depending on their categorisation can be accounted for and reported using available international accounting standards. While the lack of a common accounting standard does not cause much disparity in terms of measurement and reporting of actual GHG emissions, there is a huge difference in how firms account for emission allowances emanating from the initiatives like EU ETS. The controversy lies in how emission allowances and liabilities should be presented on the financial statements in light of prevailing accounting practices. This then calls for more work in issuing guidance of which the IASB and FASB are engaged in.

Overall the chapter has demonstrated availability of a wide range of voluntary disclosure guidelines which companies can use in preparing their GHG reports. Despite the minor differences in the voluntary initiatives, the ‘core’ disclosures are the same and hence it is expected that companies might display similarities in their GHG disclosures regardless of the guidelines used. In the UK, the GHG reporting environment is predominantly voluntary but not much academic research has been done to ascertain the impact the reporting

guidelines have had on the GHG reporting behaviour of the companies. In addition, the UK government has signalled their readiness in ensuring that firms provide measure and report credible GHG information by issuing the DEFRA (2009) guidelines. The impact of the government initiated DEFRA (2009) guidelines on firms GHG reporting behaviour is not yet known since no known empirical study has been done to that effect. By reviewing the disclosure practices of the FTSE 350 companies over a four year period covering 2008-2011, this study will assess the extent to which the disclosures reflects the disclosure requirements in the voluntary guidelines. The period covered by the study will also provide an opportunity to assess whether issuance of DEFRA (2009) had an impact on the GHG disclosures of the company. The next chapter therefore proceeds outlining the research hypothesis that will be used to fulfil the research objectives.

CHAPTER SIX

Hypotheses Development

6.0 Introduction

The chapter draws on theoretical discussions and empirical literature review presented in chapters 2 and 5 respectively to explain the rationale behind the set hypotheses. Thus based on prior evidence a list of possible determinants is drawn and these are then each discussed in light of their suitability to current study with its exclusive focus on GHG voluntary disclosures.

The chapter is organised as follows: the first part discusses the determinants beginning with corporate governance characteristics and then the firm characteristics. The chapter ends with a summary and conclusion.

6.1 Corporate Governance Characteristics

Based on prior literature (see Chapter 2 for more details), the following governance characteristics have been identified as possible explanatory factors for a firm's decision to voluntarily disclose GHG emissions information; Board Size, Presence of Non-executive Directors on board, Audit Committee, Presence of Board Environment Sub-committee, ownership concentration and Managerial ownership.

6.1.1 Board size

The board of directors, instituted as a mechanism to resolve the agency problem, has over the period seen their role increasingly becoming champions of communication between management and a firm's various stakeholders (Rupley et al, 2012; Kolk and Pinkse, 2010; Monks and Monow, 2004). Prior researchers have argued that the way a board is structured affects the way it discharges its responsibility (Galbrealth, 2010; Rogrigue et al., 2012). Based on significant progress made in corporate governance area, listed companies in the UK are expected to institute some governance structures or explain their failure to do so (Combined Code, 2012). Large numbers of board members which represent various shareholder interests may in a way help reduce information asymmetry (Chen and Jaggi, 2000). The main function of the board is to formulate policies and strategies to be implemented by management.

In discharging their role, the board is aware that information is an important link to its

outsiders as such it may champion policies that encourage more disclosures. The large number of board members is likely to make the board function effectively in ensuring that policies and strategies are implemented (Zahra et al., 2000). A large board is also likely to have diverse experience and skills that may be crucial in assisting management in the processing and disclosing of useful information (Akhtarudin et al., 2009). However there also those who argue for smaller board insisting that such boards exhibit greater operational efficiency. Thus they argue that small boards are easy to coordinate and effective, while large boards have higher coordination costs synonymous with social loafing (Lipton and Lorsch, 1992; Jensen, 1993). Coordination and communication difficulties within large boards give the CEO an opportunity to dominate in important matters, including disclosure decisions; Yoshikawa and Phan (2003) argued that CEOs sometimes create large boards as a deliberate way of dispersing power so they themselves can control the agenda. To the contrary those for large sized boards argue that large sized boards have diverse range of experience and skills which may enable them discharge their duties effectively (Dalton et al., 1999). The diversity in skills and experience means that different board members may be representing different values on the board including environmental and GHG issues. Thus dysfunctional due to large size is offset by appropriate mix of skills and experience. Moreover, Booth and Deli (1996) argue that the uncertainty surrounding environmental issues generally leads to large board sizes in order to allow firms access expertise necessary to overcome this uncertainty. In addition, de Villiers et al. (2011, p.1645) stated that larger boards means wider and diverse connections with the important stakeholders as such a firm with a large board is *'likely to facilitate access to critical financial resources, allowing such boards more financial leeway to pursue environmental initiatives'.*

Empirical studies have found evidence of the influence of large sized board to disclosures. Peters and Romi (2012) noted that in addition to other board attributes, those firms with a large board size had more GHG disclosures. Similarly, Cormier et al. (2011) found a positive association of large board size and disclosures. That study investigated whether environmental disclosures substitutes or compliments efforts in reducing information asymmetry between corporate managers and stock market analysts on a sample of 137 large Canadian companies listed on the Toronto Stock Exchange in 2005. Their environmental disclosure score was weighted with a high score awarded if disclosures are quantitative and specific than qualitative and general. The results among other factors, found that board size was the only board characteristic that had a significant positive relationship with

environmental disclosures. Others like Michelon and Parbonetti (2012) did not find any association. Given that there are both arguments for expecting a positive and a negative relationship, no prediction of the sign of the relation is predicted. It is therefore hypothesised that:

H1: There is a significant relationship between board size and GHG information disclosure.

6.1.2 Non-executive directors

The presence of non-executive directors (NEDs) is one indication of the level of board independence (Prado-Lorenzo and Garcia-Sanchez., 2010). Arguably, the presence of non-executive directors helps the board discharge its monitoring responsibilities effectively (Fama and Jensen, 1983; Akhtarudin et al., 2009). According to provision B1.2.of the Combined Code 2012, companies in the UK are encouraged to have more non-executive directors than executive directors on their boards as a way of enhancing board independence and improving board efficiency. It is intimated that board members with no material interest in the company are able to act both in the interests of shareholders and other legitimate stakeholders of the company. Thus from a stakeholder theory perspective, non-executive directors who represent the interests of other stakeholders other than management are viewed as a tool for monitoring management behaviour (Dixon et al., 2005). Such monitoring, from the perspective of agency theory, helps to minimise the principal-agency problem that exists between shareholders and management. Forker (1992) found evidence that increased numbers on NEDs on the board had led to increased quality of financial disclosures. However, in the study by Ho and Wong (2001) for Hong Kong listed companies, the positive hypothesis was not supported. Post, Rahman, and Rubow (2011) found a positive relationship between presence of NEDs and environmental disclosures while the study of Brammer and Pavelin (2006) focusing on UK companies' environmental disclosures did not find any association. However considering the uncertainty surrounding GHG matters, the presence of more NEDs on the board is likely to help a firm keep pace with the dynamics of climate change and of the action needed. The presence of more outside directors may also force or persuade firm management to be more transparent about its role in climate change which then may lead to more disclosures on GHG information. In view of this therefore we state the hypothesis as follows:

H2: There is a positive relationship between the proportion of NEDs on the board and GHG information disclosure.

6.1.3 Audit Committee Size

Audit committee is one mechanism that plays the key role of monitoring board and management activities. To enable it discharge its duties effectively, good corporate governance demands that it be made up of majority of independent NEDs and also be headed by an independent director. The UK Combined Code (2012) recommends that an AC should be comprised of at least three (or in the case of smaller companies, two) members, who should all be independent non-executive directors. Mangena and Pike (2005) explain that an independent audit committee is likely to be free from management control leading to improved operations of the board. Cadbury (1992) argued that appropriately structures audit committees have the potential to improve the financial reporting processes of a firm. The focus on audit committee is also important in the sense that it represents to a larger extent all initiatives meant at improving governance in developed countries (Ghafran and O'Sullivan, 2013). Kalbers and Forgaty (1993) argued that regardless of the characteristics of the Audit committee, the formation of the networks within committee members may provide useful links to an organisation which in turn can be vital for survival.

Empirical evidence is mixed. According to the authors, the size of the audit committee is also a symbol of resource and authority availability which is essential to the delivery of its duties. Li et al. (2012) investigated the influence of audit committee on intellectual capital disclosures of 100 listed UK companies and found a positive significant association which was consistent with the results of Mangena and Pike (2005) and Barako et al. (2006) for Kenyan companies). Aburaya (2012) also found that audit committee had a positive influence on the disclosure of environmental information in the UK. On the contrary others like Akhtarudin et al (2009) did not find any association. So no study on GHG disclosures has investigated the role of the audit committee in GHG disclosures. In this study, while it is anticipated that the presence of an environmental committee is a clear indication of a firm's seriousness in environmental matters, recognition is made that the setting up of a special environmental committee is a new phenomenon and may not be appropriate for all companies. In the circumstances, the role of audit committee is investigated on the basis that with increased awareness of environmental issues by various stakeholders coupled with the absence of a specialised committee on the environment might lead to an audit committee assuming wider responsibilities including environmental matters. Deloitte (2013) reports that social and environmental reporting has come to stay as such it is increasingly becoming an essential focus of the audit committees. Deloitte (2013) argues that environmental

information like carbon emission constitutes a significant part of operational risks as such it is incumbent upon audit committees to provide leadership oversight.

Besides, it was observed that of the firms that constituted social and environmental committees, some members of these committees were drawn from the audit committee. This could suggest desire on part of firms to draw upon the expertise of the audit committee members in establishing their oversight roles over environmental management. In the circumstances we expect a large sized audit committee to be well prepared to assume the wider responsibilities and positively influence the GHG disclosures.

H3: Firms with large Audit Committee Size will disclose more GHG emissions voluntary information

6.1.4 Environmental Committee

Prior empirical disclosure literature has investigated the role of governance structures like committees on disclosures of information (Eng and Mak 2003; Chen and Jaggi 2000; Tauringana, 1997; Peters and Romi, 2012; Berthelot and Robert, 2012). The basis of these studies is the fact that board operations through the committees mitigate the agency cost problems by way of reducing information asymmetry. The understanding is that the effectiveness of the board is not only dependent on the board composition as a whole but also the structure of its committees. Lorsch and MacIver (1989) argued that subgroups of directors in a committee enable them to consider issues of interest thoroughly than a full board would. Board committees are expected to be champions of transparency and guardians of various interest groups in particular shareholders. In this respect, agency theory supports the view that board committees and in this study an environmental committee will help monitor management activities and decision relating to GHG disclosures. Neu et al. (1998) stated that the presence of an environmental committee symbolises a firms' concern about their environmental reputation especially in the eyes of powerful stakeholders. Rankin et al. (2011, p1047) added that the presence of such a committee demonstrates 'evidence of proactive corporate governance to guide the organisational long term strategy towards a more carbon constrained future'. Peters and Romi (2012) suggests that an environmental committee occupies the same position as the audit committee in as far as environmental information is concerned. Therefore while championing implementation of long term strategies on climate change, such a specialised committee may also timely communication of the strategy and other related disclosures to the public and stakeholders.

While existence of other board committees like Audit and remuneration has always been the tradition of board structures, environmental board committees are a fairly new phenomenon. Nonetheless, Michaels (2009) noted that faced with operational and strategic environmental related challenges, firms are now designating specific committees of the board to address environmental issues. There is documented literature based evidence on the influence of an environmental committee on climate change and or GHG disclosures. Peters and Romi (2012) found that GHG emission accounting disclosures were positively associated with presence of an environmental committee of the board in the study of companies participating in the CDP from 2002 to 2006. Similarly Berthelot and Robert (2012) concluded that Canadian Oil and Gas companies with an environmental committee had higher levels of GHG disclosures than their counterparts. Rankin et al. (2011), despite hypothesising a positive relationship between GHG disclosures and governance environmental committee, no evidence was found. However the authors found that existence of operational structures like an environmental management systems and certification with ISO 14064-1 had a positive significant influence on a firm's production of credible emissions information. Other disclosure studies have also provided mixed evidence relating to existence of a specialised committee and related disclosures. Hassan (2010) focussed on corporate social responsibility disclosures and found that the presence of corporate social responsibility (CSR) committee is associated with the quantity and quality of corporate social disclosure. A similar result was obtained by Cowen et al. (1987) who concluded that human resource disclosures were positively associated with existence of a corporate social responsibility committee in a firm. However no positive association was found between the presence of a CSR committee and its related disclosures in a study by Rupley et al. (2012).

Nonetheless consistent with the desire to reduce information asymmetry and manage stakeholder relationships, in this study, it is expected that a firm with an environmental committee will disclose more GHG information as a way of satisfying powerful stakeholder demands and reduce asymmetry of information.

H4: Firms with an environmental committee will disclose more information on GHG emissions.

6.1.5 Ownership concentration

Separation of ownership and control often leads to information asymmetries that, if unchecked, are exploited by managers for their own benefit at the expense of shareholders

(Jensen and Meckling, 1976). Thus, ownership structure is considered part of the governance that helps monitor managerial behaviour. Nonetheless, monitoring becomes difficult when ownership is dispersed, due to the 'free rider' problem, with managers taking advantage of their freedom and benefitting themselves at the expense of others. It is argued that block holding (or high concentration of ownership) means stakes are high should managers make a mistake or act irrationally; the owners are therefore expected to have resources for (and a special interest in) monitoring management behaviour (Shleifer and Vishny, 1986; Noe, 2002). Shleifer and Vishny (1986) argued that large-block holders (often with a large resource base) are more likely to absorb monitoring costs than individual holders. Besides, as agency theory suggests, monitoring has costs that may eventually be passed onto managers through contractual arrangements, hence with high ownership concentration, managers may have incentives to disclose more as a way of minimising the information asymmetry and the subsequent monitoring costs.

Others have warned that where block holders have aligned themselves with managers (and so are privy to the information available to managers), they might have less incentive to push for more disclosure (Bushman and Smith, 2001). Thus, block holders' alignment with managers undermines the block holders' monitoring responsibility and often results in a conflict of interests with other groups, such as minority shareholders. In this respect, high ownership concentration is considered detrimental to voluntary disclosure. Chau and Gray (2002) assert that when ownership structure is concentrated, large shareholders have access to inside information and are less concerned about voluntary disclosure. Berthelot and Robert (2012) found a positive relationship between widely held ownership and voluntary disclosure of climate-change information by Canadian oil and gas companies. Matolcsy et al. (2012) found that high concentration of ownership had a negative association with disclosure. Similarly, Brammer and Pavelin (2008) found that UK firms with high ownership concentration disclosed less environmental information, both quantitatively and qualitatively. However, Haniffa and Cooke (2002) found a positive relationship.

Since environmental issues are sensitive, we expect ownership structure to play a crucial role in moderating the amount of information disclosed. Due to increased scrutiny by various parties and the risk associated with climate change, we expect high ownership concentration to play a crucial role in forcing managers to disclose more information on GHGs as a way of safeguarding their investments. The fact that institutional investors have collaborated through initiatives that provide a platform for firms to disclose their GHG

information (such as the CDP); their presence within an organisation may influence managers to lead by example and so make more GHG disclosures. We therefore hypothesise that:

H5*: There is a positive relationship between ownership concentration and GHG disclosure, ceteris paribus*.

6.1.6 Director share ownership

Director participation in ownership is considered one way of overcoming agency problem as it helps to align managerial interests to those of owners (Jensen and Meckling, 1976). Management exerts strong influence on the type of information communicated to outsiders because they are fully aware that outsiders judge their performance based on the disclosed information. Director share ownership places the burden of economic consequences arising from managerial actions on management themselves, thereby mitigating agency costs; hence management have incentives to reduce the cost of making more disclosures (Jensen and Meckling, 1976). In this case therefore firms with low managerial ownership could be said to have more agency costs and the need for more disclosures as a way of mitigating the costs. In addition, Morck et al. (1988) argued that managerial ownership presents an opportunity for managers to pursue self-interest non-value maximising actions at the expense of their shareholder wealth. These non-value maximising actions may include withholding of information or making inappropriate disclosures. There is evidence that increased insider or managerial ownership could lead management to make aberrant decisions (Dunn, 2004). Mohd Ghazali (2007) argued that substantial investment expected or required to be made in systems to enable a firm to discharge social and environmental responsibilities, coupled with uncertainty as to the payback possibility of such investment, may make managers with high share ownership resist voluntary activities including disclosures. The studies of Mohd Ghazali and Weetman (2006) and Ahmed Haji (2013) found director ownership to be negatively associated with disclosure.

On the contrary, Johnson and Greening (1999) argued that increased director or managerial ownership increases the probability of managers being sympathetic to social and environmental activities as they deem them potentially able to create goodwill, thus inducing customers to be more favourably disposed to their companies' products, which will in turn improve the companies' standings with other stakeholders like bankers, government and investors. However their results found that though managerial ownership was positively

related to multi-stakeholder needs, their relationship with the people dimension of corporate social performance was insignificant, leading them to conclude that 'top managers' equity does not contribute to a managerial emphasis on communities, women, minorities, and employees' (Johnson and Greening, 1999:574). Therefore in this study managerial ownership (represented by proportion of ordinary share ownership by executive and non-executive directors) is expected to be related to GHG disclosures in the negative form; hence the hypothesis is set out as follows:

H6: There is a negative relationship between directors' share ownership and GHG information disclosure

6.2 Firm Characteristics

Drawing from theoretical and empirical literature, the following company/firm characteristics have been used to draw the hypotheses: size, profitability, gearing, liquidity and industry.

6.2.1 Company Size

Corporate size is one indicator of public visibility hence large companies tend to attract the attention of diverse stakeholders. Out of intense pressure and scrutiny by stakeholders, large companies are forced to engage in other social and environmental activities as a way of maintaining their legitimacy within their operating environment (Stanny and Ely, 2008). Engagement in social and environmental activities and subsequent disclosures of the same require substantial resources in terms of finance and skill. Large firms are deemed resource capable to meet the pollution abatement costs and related disclosure costs (Freedman and Jaggi, 2005). In this case the underlying assumption is that large firms will disclose more information than small firms. The availability of resources is paramount when dealing with climate related issues which in most cases significant changes to the way a firm conducts its business. Generally size, (proxied by several measures ranging from number of employees, market capitalisation to total assets) has been used in many disclosure studies as a control variable. The majority of GHG disclosure studies have found a significant positive relationship between size and GHG disclosures (see Rankin et al., 2011 (natural log of market capitalisation); Berthelot and Robert, 2012 (total assets); Prado-Lorenzo et al., 2009 (Total revenue); Freedman and Jaggi, 2005 (log of total assets); Stanny, 2010 (log of total assets); Peters and Romi, 2011 (log of total assets)). Other disclosure studies which confirmed the

positive relationship include Reverte, (2008); Hackston and Milne (1996); Hannifa and Cooke, 2002) Therefore consistent with theory and the findings of most empirical studies on GHG disclosures, we argue for a significant positive relationship and the hypothesis is set as follows:

H7: There is a significant positive relationship between company size and the GHG disclosures

6.2.2 Gearing

Based on the tenets of agency theory (Jensen and Meckling, 1976), managers in a highly geared company are expected to disclose more information in order to minimize the agency costs. In fact leverage is considered a measure of risk exposed by both equity holders and debt holders. In essence in a highly geared company, creditors are worried that if a firm is not properly monitored then there might be wealth transfer from them to shareholders. In this case, if not provided with adequate information, creditors find their own means of monitoring management behaviour. Increased monitoring result in increased agency costs (Depoers, 2000). Therefore in accordance with the predictions of Jensen and Meckling (1976), managers increase their levels of disclosures in a highly geared company as a way of minimising agency costs. Despite the theoretical predictions however empirical GHG disclosure literature has produced mixed evidence. Freedman and Jaggi (2005) concluded that creditors had no role in determining climate change disclosures while Prado-Lorenzo *et al.* (2009) found a negative and insignificant relationship between GRI based climate change disclosures and gearing. Similarly Rankin *et al.* (2011) did not find any significant relationship between GHG disclosures and leverage for a sample of Australian companies. In other disclosure studies the evidence has been conflicting. Others have found no significant relationship (see Whiting and Woodcock, 2011) while others found a significant positive relationship (see White *et al.,* 2007; White *et al.,* 2010). While recognition is made that prior studies on climate change disclosures have not found a positive relationship between leverage and disclosures, this study will proceed hypothesise a positive relationship based on agency theory predictions. The present study has its own distinctive characteristics like its focus on FTSE350 UK listed companies and disclosure index drawn from a wide range of GHG reporting frameworks which could make it result in different outcome from prior studies on GHG disclosures. The hypothesis is set as follows:

H8: There is a significant positive relationship between gearing and GHG disclosures

6.2.3 Profitability

Based on theoretical and prior empirical evidence, profitable firms are expected to disclose more information as managers attempt to present compelling reasons for compensation and job retention (Cerf, 1961; Inchausti, 1997; Owusu-Ansah, 1999). Profitability is also an indicator of a firm efficiency in resource allocation as such management could be motivated to provide more information about their profitability and other areas of stakeholder interest as a way of attracting more capital than the less profitable firms. Brammer and Pavelin (2008) noted that profitability provides managers with a pool of resources which can be used to absorb the costs of environmental disclosures. Others also argue that profitable firms are exposed to the public than others and hence stakeholders may be interested in more disclosures as to how a firm is making its profits (Fields *et al.,* 2001). Therefore faced with public pressure, high profitable firms might use disclosures like environmental disclosures in demonstrating their profitability case (Bewley and Li, 2000). Disclosures in this respect could be a means of gaining public trust and legitimacy regarding their ways of making profits. Others however argue that it is the less profitable ones that make more disclosures as a way of reassuring their stakeholders. Reverte (2008) suggests management uses the social and environmental disclosures as being a responsible business not only motivated by the pursuit of profit and also as an investment for future profitability.

Just like the two divergent views, empirical evidence has been mixed. Using ROE and ROA as measures of corporate performance (profitability), Prado-Lorenzo et al. (2009) failed to find a positive relationship. Instead ROE had a negative and significant relationship with GHG disclosures while ROA displayed a non-significant and negative effect. Similarly Freedman and Jaggi (2005) found that ROA (as measure of operating performance) had a statistically insignificant relationship with pollution disclosures. Nevertheless other studies found a significant positive relationship (Berthelot and Robert, 2012; Amran *et al.,* 2012). Based on the conflicting evidence therefore a non-directional hypothesis is drawn as follows:

H9: There is a significant relationship between profitability and GHG disclosures

6.2.4 Liquidity

Liquidity denotes the ability of a firm to meet its short term liabilities. Based on signalling theory argument, a company with high liquidity ratio is expected to disclose more

information to distinguish itself from other companies with less favourable liquidity position (Aly *et al.,* 2010; Oyeler *et al.,* 2003; Cooke, 1989). However, the opposite may also be true if seen from the information asymmetry propositions of agency theory where firms with low liquidity positions may provide more information to satisfy capital market players and creditors demands (Aly *et al.,* 2010). Prior evidence has been mixed. Oyeler *et al.* (2003) found that liquidity was a key determinant of internet financial reporting in New Zealand and that it had a positive significant relationship with voluntary disclosure. To the contrary, Aly *et al.* (2010) found that liquidity had no influence or significant relationship with internet reporting in their sample made up of Egyptian companies.

Again, Wallace *et al*. (1994) examined the characteristics that explain financial disclosure in the 1991 annual accounts of a sample of 50 companies (30 listed and 20 unlisted) by using a very detailed index that includes 16 mandatory items. They found a significant negative relationship between financial disclosures and liquidity. Camfferman and Cooke (2002) investigated the influence of liquidity on two data sets one drawn from Dutch firms and other UK firms and found a significant positive relationship in the case of Dutch firms and an insignificant negative relationship for UK firms. No study on GHG disclosures has investigated the influence of liquidity. However, based on the assertion that environmental related activities including disclosures may necessitate adequate liquid resources, we hypothesise as follows:

H10: There is a significant positive relationship between liquidity and GHG disclosures.

6.2.5 Industry

There is documented evidence in literature that disclosure practices vary according to industry (Amran et al., 2011; Tagesson et al. (2009). Apart from size which is an indicator of a company's exposure to many stakeholders, industry membership represents a certain level of risk attached to a firm thereby attracting scrutiny. According to Young and Marais (2012) firms in industries deemed as 'sensitive' face increased stakeholder pressure for greater transparency. Thus, the dynamics and pressure of a particular industry might force a firm or firms respond to issues differently from firms in other industries. In line with institutional theory, normative and mimetic forces in a particular industry forces firms in that industry adopt common standards as way a being in line with 'acceptable' standards. Generally firms in industries deemed as 'environmentally sensitive' attract intense scrutiny from the public as such they tend to disclose more environmental information compared to counterparts in other

industries (Deegan and Gordon, 1996).

Prior studies have found evidence that disclosures are to a certain extent a product of industry belonging. Kolk and Pinkse (2010) demonstrated that firms with high environmental and social impacts began using CSR reports earlier than others, such those in the financial industry. Amran et al. (2012) studying the relationship of firm attributes, ownership structure and business network on climate change efforts in Malaysia found that among other things, industry had a positive and significant influence on a firm's efforts to mitigate against climate change. The authors had companies categorised into six industries as per Bursa Malaysia industry membership. Similarly Prado-Lorenzo et al. (2009) investigating factors influencing the disclosure of GHG emissions in companies world-wide categorised companies in 11 industrial sectors as a way of determining whether industry was part of the factors. While ten had a positive association with GRI indicators, only four namely Chemicals, Utilities, Airlines, Motor vehicles & Parts had statistical significance. Other GHG disclosure studies that found positive and significant relationship include Rankin et al. (2011) and Freedman & Jaggi (2005). In the circumstances we hypothesise that industry sector will have an impact on GHG disclosures with those belonging to the environmental 'sensitive industries' expected to provide more disclosures.

H11: There is a positive association between Industry sector and GHG disclosures

6.3 Summary

The chapter has discussed the hypotheses to be tested in this study ranging from corporate governance characteristics to firm characteristics. A total of ten hypotheses involving variables board size, NED, Audit committee, Board Environmental Committee, ownership concentration. Director ownership, company size, profitability, gearing, liquidity and industry category have been presented and their suitability justified through prior literature. The next chapter begins to discuss results of the econometric model and also the outcome of the survey questionnaire.

CHAPTER SEVEN

Research Methodology

7.0 Introduction

In preceding chapters, discussion focussed on theoretical framework, empirical literature, hypotheses development and the context in which the current study has been set out. This chapter outlines the proposed methodology and overall design used to achieve the research objectives.

The chapter is divided into four main parts. It begins by describing the research philosophy/paradigm and data collection and analysis methods. This is followed by a section on population and sample and then different aspects of secondary data methodologies are discussed based on their suitability to current study. The final part discusses the primary data collection mechanisms in particular survey questionnaire design. The chapter ends with a summary and conclusion.

7.1 Research Philosophy/Methodology

Methodology refers to a framework or procedures/principles that underpin a particular study or research. Leady (1989 cited Russell, 2011) referred to it as an operational framework to unlock the meaning of facts whereas Bogdan and Taylor (1975) described it as a set of procedures used to approach problems and seek answers. It is therefore expected that each research should clearly set out the philosophical assumption and procedural framework used to explain its findings. According to Saunders et al. (2009), such set of procedures or processes consists of six layers namely research philosophies, approaches, strategies, choices, time horizons, techniques and procedures.

The outer layer of the onion is the research philosophy which denotes development of knowledge and the nature of that knowledge (Sanders et al., 2009). There are a wide range of philosophical assumptions but the ones commonly used in social sciences and management is Ontology (realism v. nominalism) and epistemology (positivism v. anti-positivism or post-positivist) (Burrell and Morgan, 1979). Ontology originates or takes its meaning from the word theology and addresses assumptions of what constitutes social reality within the context of human nature (Wellington et al., 2005; Fisher, 2010). In this respect two contrasting positions are identified i.e. realism and nominalism (Burrell and Morgan, 1979; Saunders et al., 2009). Realism argues for the social world to be real and made up of tangible structures

while nominalism considers the social world to be just a product of constructs or labels that provide a basic structure for reality (Holden, 2004). Therefore research conducted based on nominalism require clear identification of objectives that will help form structure for reality.

On the other hand, epistemology is generally a theory of knowledge largely concerned with what does and does not constitute knowledge in a social reality (Blaikie, 1993). Bryman and Bell (2007) explains that the meaning or identification of knowledge should be within what is acceptable in a particular discipline. There are two epistemological positions namely positivism and anti-positivism (Burrell and Morgan, 1979). Under positivism, principles or methods of natural science are applied to the study of social science and hence just as in natural science, the role of research becomes to test theories or further develop them (Bryman and Bell, 2007). Generally with the positivist approach, the researcher is often independent of the study object and knowledge or conclusions is discovered or drawn through observation or measurement of the phenomenon (Krauss, 2005). On the other hand anti-positivism highlights the importance of the researcher in understanding differences between humans and social actors and do not emphasise on results generalisation (Saunders et al., 2009; Bryman and Bell, 2007).

Suffice to mention that there are other philosophical approaches within which a research can be conducted. These include Human nature (deterministic v. voluntarism) which deals with relationship between humans and their environment with the former arguing that humans have no control over their environment and that environment determines what humans should do while the latter presents humans as masters of their destiny who create environment in which social world should be understood; Methodology (nomothetic v. ideographic) relates to methods used in understanding the social world with nomothetic advocating for systematic implementation of research involving rigorous testing of hypotheses while ideographic views research as being subjective and that truth or knowledge can only be obtained by having researcher imbedded in the research; Radical change which prefers new ways of doing things and hence changes and assumptions are made that bring about fundamental changes to present order of things; and Regulation where the status quo is maintained and reinforced with a set of rules and where possible suggestions of improvements are made but within existing structure (See Saunders et al., 2009 for detailed discussion).

7.2 Research Paradigms

A research paradigm is an interpretive framework or a basic set of beliefs that guides action (Denzin and Lincoln, 2003). The paradigms transcend from the basic ontological and epistemological positions and they help classify different research approaches. The key paradigms often used in management are positivist (Classical), interpretivist/constructionist and realist (contemporary) (Bryman and Bell, 2003).

7.2.1 Positivist

According to Remenyi et al (1998, p.32) a positivism involves 'working with an observable social reality and that the end product of such research can be law-like generalisations similar to those produced by the physical and natural scientists'. In essence this involves testing of hypothesis developed from existing theory hence it is deductive in nature. Positivism assumes an external and independent existence of social world which then enables knowledge to be obtained through observations which can lead to generalisations. To obtain the valid knowledge, positivism relies on quantitative methods like surveys and experiments and statistical analysis (Blaikie, 1993; Saunders et al., 2009; Eriksson and Kovalainen, 2008).Thus research from a positivist perspective often follow a structured methodology so as to enable replication and their emphasis is one quantifiable observations that leads to statistical analysis (Gill and Johnson, 2002). In organisation context, the use of positivist paradigm assumes that organisational nature and activities can be understood by categorisation and scientific measurement of the behaviour of people and systems (Hatch and Cunliffe, 2006).

7.2.2 Interpretivist/Constructivist

Interpretivists argue that the social world is simply too complicated to be understood within a set of rules that lead to generalisations and hence epistemologically they advocate for the need of the researcher to understand the differences between humans and social actors. Generally the understanding is that humans play a part in the social world as such they interpret their social roles in accordance with the meaning given to their roles. This then means that from an interpretivist perspective there are multiple realities of the social world (Denzin and Lincoln, 2003). In this respect understanding of knowledge is often from one's own interpretation of the realities they are facing based on their experiences hence it is inductive or theory building in nature (Hatch and Cunliffe, 2006). There is no generalisation from this perspective as the emphasis is on what people think or feels, how they communicate

and hence often associated with qualitative methods of data collection (Saunders et al., 2009; Easterby-Smith et al., 2008).

7.2.3 Realist

According to realism, there is a proposition that reality exists independent of the human mind. Realism is in line with positivism to the extent that it assumes a scientific approach to the development of knowledge but it is less deterministic than positivism. It also draws from interpretivism in that though it is concerned with the existence of things and how these things behave, it also acknowledges that things may just exist without science or observation hence the need to pay attention to these things as well (Blaikie, 1993). Thus while realists tore the interpretivist position that social reality is pre-interpreted, it also goes along with positivism notion that science should be empirically based with clear rationale and objectives rather than mere reliance on language or discourse. Hatch and Cunliffe (2006) explain that with realism, reality appear in stratified form in which surface events are shaped by underlying events and that what is observed is only partial than complete. Bhaskar (1989) explain that research can identify what we don't see through practical and theoretical processes of social sciences. Therefore to enrich knowledge acquisition and understanding, realism encourages research to be undertaken from multiple perspectives and hence is often seen as inductive or theory building.

7.3 Research Methods

The choice of research method in a study is informed by the ontological or epistemological position taken by the researcher. However, broadly there are two methods of research often discussed in literature and these are quantitative and qualitative methods. Though these two methods constitute alternative strategies, it is advisable to view them as complementary with quantitative methods able to provide breadth of the study and qualitative providing depth and detail (Patton, 2002; Jick, 1979).

7.3.1 Quantitative Method

Quantitative methods fall under nomothetic methodology where the key objective is to search measurable observations to understand things (Creswell, 1998; Hussey and Hussy, 1997). It follows a deductive approach and incorporates the practices and norms of natural science which treats social reality as an external and an independent object (Bryman and Bell, 2003). Due to its positivist inclination, findings from quantitative research can be generalised and the study can be replicated (May, 2001).However the disadvantage of quantitative method is

that overreliance on measurements, instruments and theory may risk making research to be a distant apart from everyday reality (Bryman and Bell, 2003).

7.3.2 Qualitative Method

The qualitative approach emphasises words rather than numbers or quantification in the collection and analysis of data. It aligns with both constructionist/interpretivist paradigm and ideaographic methodology. In this perspective, there is greater role for human nature which is assumed to have an urge to volunteer and is totally autonomous and free willed which then makes them able to create the environment rather than the environment influencing them (Burrell and Morgan, 1979). Its data collection procedures may involve interviews, documents and sometimes audio visual (Creswell, 2003). With qualitative method the social world is understood or examined through interpretation of that world by participants (Bryman and Bell, 2003). It is often considered the more suitable method in circumstances where little or no meaning can be deduced from numbers alone and is also seen as a method that can successfully bring together theory, human interactions, meanings and any relationships that may exist. But its critics point to its lack of repricability and results generalisation ability as its weakness (Bryman and Bell, 2003). Others also point to its active involvement of human actors as weak point that makes it lack objectivity (Morgan and Smircich, 1980).

7.4 Approach to the Current Study

This study whose aim is to investigate the extent and determinants of voluntary GHG disclosure studies by FTSE350 companies in UK will mainly adopt a positivist position. In this case knowledge is seen as main objective to arrive at social world reality of the GHG voluntary disclosure. Literature has been used to inform the study and it is set out to test existing theory through a set of hypotheses and hence will rely on quantitative data. The research will mainly rely on regression analysis and due to the nature of the data set panel regression analysis will be employed. The study is also interested in understanding whether the knowledge as informed by theory is perceived as such in practice so as to enrich the understanding of the phenomenon behind voluntary disclosure in general. In this respect, it is considered to be deductive in nature. Suffice to mention that in voluntary disclosure and GHG voluntary disclosure in particular, the deductive-hypothesis approach has been used widely (Freedman and Jaggi, 2005; Rankin et al., 2011; Peters and Romi, 2012 etc.).

7.5 Data Collection Sources

Data sources are generally categorised into two namely primary data and secondary data.

7.5.1 Secondary Data

This refers to readily available data but one that is published for other reasons other than the research problem at hand. According to Saunders et al. (2009), secondary data can be gathered through different sources including books, companies' annual reports, media sources, government publications etc. Researchers note that the main advantage of secondary data is that it is cost effective and saves time and that sometimes its nature may permit longitudinal analysis (Bryman and Bell, 2003). However some of the limitations of secondary data include lack of control over data quality, lack of familiarity with data and sometimes the dataset might be incomplete (Saunders et al., 2009). To a large extent this study will rely on secondary data particularly annual reports.

7.5.2 Primary data

Primary data involves the generation of new data set specifically for the research problem at hand. Primary data can originate from respondents, analogous situations or experimentations (Kinnear and Taylor, 1991). In the present study, discussion is limited to respondents' category due to its suitability for the study. According to Kinnear and Taylor (1991, p.135), where a 'study require data about respondents' attitudes, perceptions, motivations, knowledge, and intended behaviour, asking people questions is essential'. In this respect the techniques used include observation, interviews, and questionnaires etc. Due to the intention of triangulating the results, the study will also use primary data particularly collected through survey questionnaire.

7.5.2.1 Survey Questionnaire

Questionnaires can be administered in four ways namely through postal, on-line, face to face interview and telephone interview (Robson, 2002; Forza, 2002). Questionnaires often follow a structured approach and questions are constructed after a careful review of theory and prior evidence and hence are characterised as being positivist. When questionnaires are of positivist in nature then questions are closed in nature whereas in cases where questions are open then they are considered to lean towards the ant positivist approach (Collis and Hussey, 2003). Where questionnaires are administered through postal as opposed to face to face interviews the anonymity is increased and the interviewer effect is eliminated thereby making it more convenient for the respondents. However its limitation is lack of control by the researcher over completion process which may lead to low response rates (Bryman and Bell, 2003). Those administered through email are likely to yield high response rates and are of low cost in nature but they are limited to the on-line population (Kent and Lee, 1999). In this

study a postal questionnaire was used due to the nature of the target sample. Please refer to section 7.10 on how the survey was constructed and administered.

7.6 Triangulation

Triangulation involves combination of methodologies in the same study (Denzin, 1978). According to Bryman and Bell (2003) triangulation enables the researcher to address different angles of the issue at hand and increases the probability of the research achieving high degree of validity and credibility while overcoming single method limitations. Triangulation can take different forms namely data triangulation, observer triangulation, methodological triangulation and theory triangulation (Robson, 2002). In this study, data triangulation and theory triangulation is used to compare and contrast theory based findings and the perception of GHG emissions information preparers. Data triangulation entails the use of more than one method of data collection whereas theory triangulation involves use of multiple theories or perspectives (Robson, 2002). Nonetheless critics of triangulation point to the fact that it is difficult to replicate results since personal perceptions are involved (Lamnek, 1993).

7.7 Population and Sample

In order to test the hypothesis and meet the research objectives, the study made use of annual reports, stand-alone environment or sustainability reports over a four year period i.e. 2008-2011 drawn from a sample of FTSE350 companies. The FTSE 350 is chosen largely due to two reasons namely; it is considered broader enough to cover a wide range of industries and that it comprises big companies which may set pace in as far as GHG reporting is concerned. Thus the focus of large companies is in line with prior studies on GHG reporting (see Freedman and Jaggi 2005) and Prado-Lorenzo et al 2009) who argued that large companies are more likely required to, be reporting to regulatory agencies and that they could be more concerned with pollution disclosures than small or medium sized companies. The use of large companies is also in line with theory (e.g. stakeholder theory) which suggests that large companies are bound to disclose more information to serve diverse needs of stakeholders. In addition, according to Brammer and Pavelin (2006), the use of large companies drawn from a diverse range of industries permits a comprehensive review of the disclosures and reasonable generalizability of the results.

The period 2008-2012 is chosen because a number of significant milestones were laid by the UK government in the fight against global warming. The Climate Change Act 2008

was enacted followed by the issuance of DEFRA (2009) on the voluntary measurement and reporting guidelines for GHGs. Besides, the government through DEFRA conducted a study aiming at understanding the impact of GHG reporting on GHG emission control and found that there is an indirect link GHG reporting and GHG emissions control hence there are plans to make GHG reporting mandatory by 2013. Arguably through these initiatives, issues pertaining to GHGs reporting have had increased awareness which is paramount in incentivising the companies to report voluntarily. More importantly in this study, the issuance of DEFRA (2009) is considered potentially significant in influencing corporate GHG disclosures. Since the signing of the Kyoto Protocol in 1997 and the issuance of the IPCC report (2009) and other high profile climate change summits like the Copenhagen (2009), the public awareness of the dangers of climate change has been increasing forcing nations to take decisive steps to slow the pace of global warming. A number of private initiated GHG reporting guidelines have been issued over the years to help companies measure and report GHG emissions and the issuance of DEFRA (2009) is more complementary to these. Therefore investigating the disclosure trends at the chosen period when the interest in the topic was high on the agenda of both business and political leaders would help demonstrate whether such a rise in interest has been translated into meaningful action by the corporate world. Besides, the choice of longitudinal data will help explain whether these initiatives had an impact on the GHG disclosures.

The study of a UK based sample will help track the impact of the efforts and initiatives introduced by the government is helping firms report GHG emissions. Cognisance of the fact that GHG reporting initiatives have been championed by various regulators and private institutions worldwide, the choice of FTSE350 companies will help the study have a sizeable number of companies with multiple listings, which suggests a sample of firms meeting similar disclosure pressures which may be crucial when considering results generalizability.

The selection of the sample starts with getting a list of FTSE 350 companies available on London Stock Exchange website on 10 October 2011. The final sample was chosen based on the following criteria. Financial sector firms, including banks, insurance companies, investment trusts, unit trusts and real estate companies, are excluded from the sample because they are subject to different disclosure and statutory requirements that may significantly affect their accounting policies, disclosure decisions and corporate governance structures (Ntim and Soobaroyen, 2013). The total number of financial firms excluded was 93. In

addition, firms with unpublished annual reports and/or missing data on *DataStream* and elsewhere (e.g. as a result of deletions caused by subsequent mergers and acquisitions) are deleted to assure comparability of the results. Other reasons for exclusion include a company not being listed for the entirety of the study period and where a company is a subsidiary of another company already represented in the sample. A total of 42 firms were excluded using these criteria. The final sample came to 215 firms which over four years translates to 860 firm years drawn from a total of 9 diverse industries. Find below tables 4 and 5 summarising the outcome of the final sample and the industrial representation in the sample.

Table 4 – Sample from FTSE350

FTSE350 UK Listed Companies	Number of companies
Total Firms at start	350
Financial Firms excluded	93
Other Firms excluded (due to insufficient data, mergers etc.)	42
Final Sample	215

Table 5 – Sample companies by industry sector

Sector	Number of Companies	Sector % of Sample
Oil & Gas	17	8%
Basic Materials	26	12%
Industrials	61	28%
Consumer Goods	24	11%
Health Care	7	3%
Consumer Services	52	24%
Telecommunications	6	3%
Utilities	8	4%
Technology	14	7%
Total	215	100

As per table 5 above, the majority of the firms in the sample were categorised as Industrials (28%) seconded by Consumer Services (24%).

7.8 GHG Disclosure Measurement Instrument

In order to achieve objectives one and two, the study involved the construction of a disclosure index based on the various available guidelines on GHG measurement and reporting. Construction of the GHG disclosure index entails that the study follow the general principles of content analysis which is a widely used technique in disclosure studies (Freedman and Jaggi, 2005; Prado-Lorenzo et al 2009; Clarkson et al 2008; Stanny and Ely 2008). Content analysis is used in both quantitative and qualitative studies as a way of measuring the volumes of disclosure with the intention of drawing inferences or meanings about those disclosures (Gray et al 1995a; Krippendorff, 1980; Unerman, 2003). Krippendorf (1980, p.21) defined content analysis as 'a research technique for making replicable and valid inferences from data according to their context'. This aligns with the definition of Holsti

(1969) who referred to content analysis as the research technique for making valid inferences through objective and systematic observation of the characteristics of the message. Silverman (1993) considered content analysis as the analysis of texts and documents. Content analysis involves codifying and categorising texts according to their groups based on predefined criteria or standard (Wolfe, 1991). Thus the availability of a standard/criteria means that one advantage of content analysis is that the outcome is replicable, reliable, systematic and above all, objective (Krippendorff, 1980). In addition, Wolfe (1991) observed that content analysis has several advantages to the researcher among which is the ability to provide opportunity to analyse documents produced on regular basis at different times on a longitudinal basis and that it allows the researcher to work directly with core human and organisational behaviour communication.

Bryan and Bell (2007) explained that by being systematic, content analysis procedures supress the level of bias and ensures results reliability.Content analysis is conducted in different stages. Weber (1994) identified a series of stages that a content analysis should go through as follows: Identify questions to be investigated; Determine the sampling units; Determine and define the content categories; Determine the recording units; Determine the coding mode; Test coding on sample of texts; Assess reliability and validity. Going through each of these stages enable the researcher to address important elements of the research notably which documents to be used in the analysis; what kind of information/items to look for and how to look for the same i.e. coding. Determining the recording units and coding mode are considered fundamental to the reliability and validity of the results.

7.8.1 Determining the Recording Units

In determining the units, selection of the sample unit and the components of the texts/words to be analysed is considered important (Krippendorff, 1980). Krippendorff (1980: 57) defines sampling units as "those parts of observed reality or of the stream of source language expressions that are regarded independent of each other". In order to address research objective one and two, the sampling unit in this study is primarily the annual reports and if available the sustainability report. This is in line with a stream of current literature focusing on GHG disclosures which have used a wide range of sources including annual reports, sustainability reports and website information in analysing the GHG disclosures (see Freedman and Jaggi, 2005; Rankin et al., 2011). Prado-Lorenzo et al. (2009) argued that the use of multiple sources help overcome the limitations of prior studies that depended on single

source and that it is recognition of the fact that corporations are increasingly relying on a number of communication channels to relay their important information.

7.8.1.1 Annual Report

Considerable amount of research have relied on the annual report as a sampling unit (Deegan and Rankin, 1996; Gray et al., 1995a; Guthrie and Parker, 1990; Patten 1991; Oliviera et al. 2006; Unerman, 2003; Berthelot and Robert, 2012). A number of reasons are cited in disclosure literature regarding the annual report being an essential sampling unit. Gray et al. (1995b) explained that the annual report is generally considered to be an official and legal document in which organisations attempt to reconstruct their image. In most cases the annual report is used as a platform for revealing organisation information to its stakeholders (Adams *et al*., 1998; Botosan, 1997) and more importantly others like (Gibson and O'Donovan, 2007; Wiseman, 1982; Owen, 2008) report that annual reports were increasingly being used as the main communication platform for companies' social and environmental disclosures. The regular pattern in which annual reports are produced also makes them a reliable source of information. In all, prior disclosure studies have argued that annual reports are credible and consistent when compared to other forms of communication (Neu et al., 1998; Tilt, 1994), accessible and widely distributed (Campbell, 2000), and formal and statutory (Buhr, 1998).

The use of the annual report as part of the sampling unit in this study is on the understanding that climate change being an important topical element affecting various segments of a company's operations is likely to be a prominent feature of elements reported in the annual report. Aerts and Cormier (2009) argued that for firms whose intention is to signal good environmental behaviour then there is no other place other than the annual report. Thus the annual report, being the most comprehensive document covering the overall performance of a firm, could be deemed incomplete if such important information as climate change and GHG gases emissions are not afforded commentary or coverage in separate segments of the annual report or within other existing segments like the risk aspects of the business. The other basis for choosing the annual report is that the Companies Act 2006 requires companies to report environmental information (including GHG information) as part of KPIs reported in annual report. Besides, companies' information pertaining to risks in a broader sense of which climate change and GHGs could be part of, are expected to be disclosed within the annual report (ICAEW, 2002). More importantly, most studies on GHG disclosures have considered the annual report as one important sampling element (Berthelot and Robert, 2012; Rankin et al 2011).

7.8.1.2 Sustainability Reports

While the use of annual report as a sampling unit is widely accepted, others argue that exclusive focus on annual reports alone may mean incomplete or partial understanding of the reporting behaviour of companies (Sen et al., 2011). Holland and Foo (2003) argued that the sole focus annual report may lead to wrong conclusions because in recent times, organisations produce a separate sustainability report which may be interpreted as a signal on their part that environmental/sustainability reporting is deemed important just like as other parts of financial reporting. Unerman (2000) warned that the sole reliance of annual reports as a medium of disclosures risk underestimating the volumes of disclosures companies engage in. Indeed there has been recognition of the growing importance of other forms of communication channels like internet and stand-alone sustainability reports (Sen et al., 2011) as such researchers have also been turning their attention to these. Sustainability studies and in particular those exclusively focussing on GHG disclosures have in addition to annual reports used sustainability reports, and website information (Freedman and Jaggi, 2005; Prado-Lorenzo et al., 2009). Other disclosure studies have also used stand-alone reports to assess the level of disclosures (Ho and Taylor, 2007; Harte and Owen, 1991). While it is appreciated that focussing on annual reports is a risky option which may lead to incomplete picture of the disclosures, a review of disclosures in all possible avenues is deemed impossible due to resource constraints (Unerman, 2000). Therefore in this study, only the sustainability/environmental reports will be used to complement the disclosures in the annual reports.

7.8.2 Text of analysis in sampling Unit – Disclosure Index

Content analysis demands a clear outline of the subject matter under investigation. Gray et al. (1995b) advises that an objective criterion is one which can be confirmed by an independent person doing a similar exercise. A systematic criterion is one which involves a comprehensive set of rules defining what is and is not GHG disclosures in the sampling units chosen. In this study, company GHG emissions disclosures are assessed using a disclosure index or check list following prior studies (Clarkson et al., 2008; Stanny and Ely, 2008; Rankin et al., 2011; Berthelot and Robert, 2012). Generally the disclosure index is considered to be the main means of evaluating information disclosures in both public and private companies (Bonson and Escobar, 2006). Here, an index is constructed based on GHG disclosure requirements stipulated in various reporting frameworks in particular GHG protocol, DEFRA (2009), ISO 14064 etc. (See appendix 5 which outlines the checklist

items).

The checklist was drawn as follows: Prior literature was extensively studied to understand the basis of their disclosure instruments *vis-a-vie* their suitability to the current study; All GHG measurement and reporting frameworks applicable in the UK were reviewed outlining their differences and similarities with a view of documenting items deemed essential (loosely determined by the frequency/common appearance in various disclosure guidelines) in the disclosure of GHG information. While reviewing the disclosure frameworks it was discovered that some disclosure items were very particular to certain organisation and could only be disclosed if an organisation deemed them necessary in a particular period. These items include information about linking executive compensation to environmental performance, Co2 emissions from combustion of Biomass; purchased or developed GHG emission reduction and removal enhancements; and a description of applicable GHG program requirements. Since it is very unlikely that all organisations can engage in transaction that will require disclosures in these categories then a decision was made to drop these items from the checklist. In addition, after a pilot study which comprised 76 companies of the studied sample, it was noticed these items were hardly disclosed. Such absence may indicate their lack of importance as such these items were also dropped. In addition to assessing the index against prior studies and existing GHG disclosure guidelines, the validity and suitability of the research index was reviewed and confirmed by three independent persons in the UK two of which are experienced academics and one a PhD student with considerable experience in Accounting and Finance. The final tally on total items in the disclosure was 60 Categorised into two namely qualitative (34) and quantitative (26). This checklist is comparatively broader and comprehensive than previous studies like Prado-Lorenzo et al. (2009) who had a checklist of 19 items only and other prior studies that have only used one reporting framework since it pools together all the important elements required in the disclosure of GHG information. The disclosure items used in this study are in appendix 5.

After construction of the disclosure index, the next stage was quantification of constituent components of the index. Evidence from prior literature indicates two ways in which disclosure item quantification can be done i.e. through weighted approach (see Buzby, 1975; Freedman and Jaggi, 2005; Rankin et al., 2011) or un-weighted approach (Prado-Lorenzo et al., 2009; Wallace and Naser, 1995). The weighted approach involves assigning different weights/numbers to the items on the disclosure checklist based on the understanding

that each item can have different meaning and importance to stakeholders whereas the un-weighted approach uses the dichotomous procedure in which an item is scored 1 if it is disclosed or 0 otherwise assuming that every item is important to the users of the annual reports. Both approaches have inherent limitations in estimating the level of disclosures and are thus criticised the former for being prone to subjectivity and the latter for being naïve in assuming all items have equal relevance in decision usefulness (Marston and Shrives, 1991). Where subjectivity is involved like in weighted approach then reliability and comparison of results is difficult and questionable. Both approaches have been used in studies pertaining to GHG disclosures. In particular Freedman and Jaggi (2005) used both approaches in their study and found consistent results while Prado-Lorenzo et al. (2009) only used the un-weighted index and found results that were in consistent with those of Freedman and Jaggi (2005). Therefore considering that the use of both weighted and un-weighted indices seem to yield similar results, this study has adopted the un-weighted index approach. Hence the total number of scores a company can get is equal to the total number of items on the disclosure checklist.

7.8.3 Disclosure Scoring Rules and Process

After determining and defining the content categories through the development of the GHG disclosure index, the next critical stage is to decide how to capture and identify information themes from the disclosure sources. This takes two forms namely coding which is identifying information or items from the annual reports/sustainability reports and then measuring decisions which aims at assigning meaning to the coded themes (Campbell et al., 2006). To ensure a credible coding system that can facilitate replicability of results, Gray et al. (1995b) advises the use of well-established decision rules. Thus decision rules help to clarify which items should be coded or scored under which category in the designed disclosure instrument. Since the study of GHG disclosures is relatively new, there are no established rules regarding the coding process of information. Prior studies (Prado-Lorenzo et al., 2009; Freedman and Jaggi, 2005; Rankin et al., 2011, Choi et al., 2013) relied on the procedures done in other studies focussing on environmental disclosures and the specifications within the source of their research disclosure instrument. In this study, the requirements of various GHG reporting frameworks are complemented by the decision rules on environmental disclosures developed by the UK Centre of Social and Environmental Research (CSEAR). Other studies like that of Aburaya (2012) investigating the quantity and quality of environmental disclosures in the UK also used the CSEAR rules. Below is a list of the rules used:

- Any disclosure item that discusses or mentions the GHGs or climate change and/or their relationship to the organization is recorded.
- All disclosures must be explicitly stated, they cannot be implied meanings.
- All disclosure items are to be recorded regardless of their format, including financial statements, narratives, and non-narratives such as pictures, photographs, charts and graphical representations.
- Disclosures having more than one possible classification or containing two or more information items are classified under each relevant category or item.
- Repeated disclosures are not recorded, disclosures containing the same information item are considered only once.

Having designed the disclosure index and the coding rules, the next step was to decide on the unit of analysis to be used in this study. Disclosure literature provides two options in which information content can be assessed namely using a measuring unit and a scoring system (Al-Tuwaijri *et al*., 2004). Measuring units include counting words (Deegan and Gordon, 1996) sentences (Wiseman, 1982; Milne and Alder, 1999) or page proportions (Campbell, 2000). The scoring system was adopted in this study since it was felt mere counting of words or sentences may not be ideal in a highly sensitive area of climate change related disclosures in which companies are rumoured to 'greenwash' rather than disclosing substantial steps or actual reductions in GHG emissions (Stanny, 2011; Hrasky, 2012). Besides, others like McMurtrie (2005) discredit the use of sentences or words to determine disclosure arguing that one risks leaving important powerful messages relayed through other means like tables, photographs, graphs etc. It is expected that scoring procedure that takes into account a thorough review of disclosed information with a view of determining whether required items are disclosed will not only demonstrate the quantity but also the quality characteristics of the disclosures which is essential in decision making. This is important in climate change and GHG disclosures because the primary reason companies are encouraged to disclose is because it is believed that through measurement and disclosure they can keep control of their emissions. In this respect it is therefore appropriate that any instrument used to measure GHG disclosures is able to bring out issues that can enable interested parties understand the substance of the disclosures rather than sheer volumes through words and sentences. This is in line with prior studies on GHG disclosures like Freedman and Jaggi (2005) who considered both the requirements & consequences of Kyoto protocol and the

issues relating to shareholder environmental needs when designing the scoring instrument.

Before the scoring process commenced, another important element considered was the determination of the volume of disclosures to constitute an item on the disclosure checklist. Disclosure literature recommends two options. One is the use of binary variable, which takes the form of 1 if it is reported or otherwise 0 (Cooke, 1989) while the other estimates a score ranging from 1 to 0 or any other ranges deemed necessary. The latter option is not widely used and others like Giner (1997) have criticised it for being prone to subjectivity. The studies focussing on GHG disclosures have used either option. Freedman and Jaggi (2005) while using a weighted disclosure index also used an estimated score of disclosed information based on what they called 'our perception of their (information content/items) contribution to the evaluation of a firm's global warming performance' while Rankin et al. (2011) also weighted the volumes of the disclosures on a scale of 1to5 to reflect the relative importance placed on the item by their source i.e. ISO 14064. Thus according to Rankin et al (2011), where the ISO 14064 required an explanation behind a disclosure item then scoring weights of between 1 to 5 were assigned to assess the quality of the explanation. However the study by Prado-Lorenzo et al. (2009) used the binary variable of either 1 or 0 depending on whether the item is disclosed or not arguing that subjectivity presented a major challenge for the other option and that their study which also considered internet reports or website information was better suited for binary variable option. This study focusses on the availability of the disclosures in line with what is required in various reporting guidelines as such it does not place any importance on any kind of disclosure. Therefore in line with Prado-Lorenzo et al. (2009) and other disclosure studies (Hossain and Hammami, 2009; Hossain, 2000), the study adopts the binary variable disclosure option. Besides there is no any particular basis to support that certain items of disclosure under climate change or GHGs are more important than others and moreover Chow and Wong-Boren (1987) add that using an equal- weight (or un-weighted) scoring system permits an analysis to be independent of the perceptions of a particular user group which is a key consideration in differential weighted index studies (Firth, 1979).

Based on the coding rules and procedures outlined above, the annual and sustainability reports of the sampled companies covering a four year period i.e. 2008-2011 were downloaded and carefully analysed/scanned in order to judge the suitability of the disclosures to the disclosure checklist items. In the annual reports, particular attention was paid to the narrative sections of the reports where the majority of other disclosures are made.

In sustainability reports, emphasis was placed on sections relating to environmental information where GHGs are presented in most reports. Disclosure index forms were used to record the scores emanating from the review of the reports. Recording was done by ticking the disclosure items on the checklist based on the reviewed information and any additional information deemed important but cannot be accommodated within the categories of the disclosure items was written at the bottom of the relevant disclosure score sheet for further consideration during analysis. Thereafter the contents of the disclosure scoring sheets were transferred to an excel sheet for further data manipulation and analysis.

As mentioned, the maximum score a company can get is 60 which is the total number of items on the disclosure checklist. The total score for a company is derived by summing all the scores attained as per score sheet. Subtotals per category i.e. qualitative and quantitative are also obtained by summing up all the scores in that particular category. Below is estimation on how the total scores are derived expressed as a proportion of the total maximum possible scores:

$$CGHGD\ quantity = \frac{\sum_{i=1}^{n} Quantity}{MaxDis\ Score}$$

Where:

CGHGD is the Corporate GHG disclosure quantity

Quantity$_i$ = 1 if item *i* is disclosed; 0 if item *i* is not disclosed,

Max Dis Quantity Score is the maximum applicable disclosure quantity score,

n = number of items disclosed

7.8.4 Reliability and Validity of Coding Process and Disclosure Index

Reliability and validity of the coding process as well as the disclosure index was given due consideration in this research to ensure accuracy and consistency of results. Coding and measurement reliability is considered essential in having research outcomes that can be reproduced by another researcher (Webber, 1990).

7.8.4.1 Reliability assessment

Reliability relates to the repeatability of results if the same instrument is used several times (Carmines and Zeller, 1991). This suggest that when a company is scored high using the

same instrument then repeated trial should yield the same results and this should be the same for the sample of population being tested. Hassan and Marston (2010) identified three forms of reliability assessment namely test-retest, inter-coder reliability and internal consistency. Test-retest concerns the stability of results obtained from a measurement instrument over time and in studies involving a disclosure index this could be obtained by the same coder coding same content more than once (Hassan and Marston, 2010). Hussainey et al (2003), using Nudist software coded all annual reports at one point and after a short period coded them again using the same software and had the scores matched thereby proving the stability of the measurement instrument. Critics consider it uneconomical in terms of time, money and effort more especially when the scoring is done manually (Hassan and Marston, 2010).

Inter-coder reliability is another form of reliability test which involves more than one researcher coding the same sample using the same instrument and obtaining same results (Milne and Alder, 1999). Comparison of results is done through correlation computations and the higher the correlation coefficient the higher the reliability of the index. Despite high correlation coefficients, discrepancies between coders are expected to be resolved if the instrument is to be deemed reliable. Tauringana (1997) used the expertise of three academics that were professionally qualified in the accounting field. Disclosure scores obtained after retest of a sample of 10 companies by the researcher was compared to perceived disclosure scores by the three academics. Then thereafter companies were ranked according to disclosure score from the index and the disclosure rating number assigned by the academics. Correlation coefficients were high and the instrument was deemed suitable. The other form of inter-coder testing was performed by Rankin et al. (2011) in their study of the determinants of GHG disclosures in Australia. In this study, all members of the research team used the same index to score the reports and compared results. Discrepancies were resolved and the appropriate use of the instrument was agreed upon. Before the revised instrument was finally used, a further sample of ten companies were scored by one member of the team and checked by another to ensure that the index had been applied as initially agreed. The consensus was then reached. Other studies like Linsley and Shrives (2006) have tested inter-coder reliability using Scott's pi. Scott's pi calculates the level of inter-coder reliability after eliminating agreement due to chance. Generally a pie of 0.8 is considered very good while one below 0.5 is deemed poor. Others calculate Krippendorff's alpha and/or Cohen's kappa (Beattie et al., 2004).

Internal consistency is the third form of reliability testing and it is an indicator of how

well the different items in an index measure the same issue (Litwin, 1995 cited Hassan and Marston, 2010). Cronbach's alpha (which estimates the expected correlation between one test and a hypothetical alternative form containing the same number of items) is the popular measure of internal consistency. It takes a value from one to zero and an alpha of 0.8 for widely used scales is deemed suitable. Hassan et al (2009) used Cronbach's alpha to measure the internal consistency of the items in their disclosure index.

Notwithstanding the fact that the measures of reliability are well known and applied in other studies, they are rarely performed or reported in accounting disclosure studies. Hassan and Marston (2010) reviewed a total of 50 cases and discovered that only 16 had performed and reported the procedures undertaken to ensure index reliability. In a total of 15 quantitative GHG disclosure studies reviewed in this study none reported reliability test. In this study a comprehensive reliability test has been performed based on essentials as outlined by Krippendorf (1980).

In fact, Krippendorf (1980; 2004) identified three areas of consideration for reliability to be achieved and these are stability, reproducibility and accuracy. Stability relates more to the coder being able in achieving consistent scores/results over time. Stability of the coder can be attained through proper training of the process i.e. by testing a pilot sample or by having clear stipulated rules (Milne and Alder, 1999; Krippendorff, 2004). In this study both options were adopted. First, though the researcher is considered partly experienced in disclosure index studies having done two similar studies in the immediate past, a pilot study was undertaken to determine the suitability of the coding process and the disclosure instrument. The pilot study sample comprised 76 company annual and sustainability reports over a four year period. Before the disclosure index was used in the pilot study, it was intensely scrutinised by two independent academics with extensive experience in disclosure studies. Once the instrument was agreed upon, the initial coding and scoring process was done by the researcher and one PhD student in Accounting and Finance on 10 randomly selected companies over a four year period in the pilot study. The use of another independent coder was to attain reproducibility of the results. The two outcomes had minor variations as such the researcher proceeded to scoring the reports of the companies in the pilot study after resolving the same. During the scoring process it was discovered that certain elements included on the disclosure index notably on future estimates of risks arising from climate change were not disclosed by any of the companies in the sample particularly due to the fact that these were not common in most disclosure guidelines. These are considered inapplicable

items which according to prior studies (Chau and Gray, 2002) could be dropped to avoid penalising companies for non- disclosure unnecessarily. Accordingly these were dropped and the index was refined accordingly. Consistency and fairness in the scoring process was also improved by sticking to the rules adopted in this study. The outcome of the pilot study confirmed the suitability of the coding process and the GHG disclosure index.

After the pilot study but before the commencement of the actual study, the disclosure index was again reviewed by the researcher and three independent academics, two of which were not involved in the pilot phase. Like in the pilot phase the academics had considerable experience in disclosure related studies. This review was meant to capture any important item or drop an unnecessary item which might have been overlooked during the pilot phase. The use of a panel of experts like academics is widely used in literature as a way of validating the content of the disclosure checklist (Sekaran, 2003). This resulted in minor review of the instrument particularly focusing on the wording and positioning of some items. Similarly, an initial coding and scoring of 10 companies over a four year period was done by five persons including the researcher. The other four comprised three independent academics and one PhD student in the Accounting and Finance stream. The results showed no significant differences in the scores. The minor differences centred on scoring the identification of the contact person responsible for climate change/GHG reporting within an institution in that among those that disclosed, they either identified a person or a committee. Discussions were held to discuss and reconcile the differences.

Find below a table 6 summarising the correlation matrix results of the five independent researcher.

Table 6: Correlation among Independent Disclosure index scorers

		1	2	3	4	5
1	Current Study Researcher	**1.000**				
2	PhD Student	0.9766***	**1.000**			
3	Experienced Academic A	0.9689***	0.9159***	**1.000**		
4	Experienced Academic B	0.9615***	0.9691***	0.9375***	**1.000**	
5	Experienced Academic C	0.9540***	0.9431***	0.9201***	0.9045***	**1.000**

The correlation matrix from the table indicates that the scores were strongly correlated and significant at *p<0.000*. Literature based evidence (Ahmed and Courtis, 1999; Botosan, 1997) suggests wide reliance on correlation matrix in assessing the validity of disclosure scores. In this respect therefore the coding process and index scores are deemed reliable. In addition, a series of statistical reliability tests like the Scot's Pi, Cohen's Kappa and the Krippendorff *alpha* was calculated to further enhance reliability of the content analysis results. The Krippendorff *alpha* obtained was 79% and this compares favourably to the minimum agreement threshold of 70% (Neuendorf, 2002; Krippendorff, 2004). Both the Cohen Kappa and the Scot's Pi were close to 80.0% and hence deemed satisfactory.

Table 7 – Statistical reliability tests of the disclosure scores

	% agree	Scot's Pi	Cohen's Kappa	Krippendorff's Alpha	No. agreed	No. Disagree	No. Firms
Pilot vs Final sample	80.30%	0.795	0.796	0.797	61	15	76

In calculating the Krippendorff alpha, Scot's Pi and Cohen's Kappa, firm scores as per pilot study scores are compared to the same firm scores in the final sample. Overall an agreement of 80% suggests sufficient reliability in the method followed.

7.8.4.2 Validity assessment

Validity concerns the ability of the instrument/index/process to measure the concept in the manner intended by the researcher (Sekaran, 2003). Validity takes three forms: criterion validity, content validity and construct validity. Content validity is about how adequate/representative are the items included in a measure and is generally assessed through seeking subjective judgement from both experts and non-experts in the field. Since it involves subjective judgements, some consider it inadequate to measure validity (Hassan and Marston, 2010). Rajab (2009) sought the expertise of two experienced researchers in risk disclosure when validating his scores. Similarly, Aburaya (2012) also used three academics with expertise in audit to help in refining the disclosure checklist. In this study the expertise of three independent academics has been sought and used.

Construct validity focusses on the extent to which a measure is consistent with theoretical expectations and literature based evidence. Hassan and Marston (2010, 30) noted

that ‘testing for the construct validity of a measure of disclosure requires a pattern of consistent findings with prior studies’. In this study a comprehensive review of GHG and other general disclosure studies has been done leading to identification of Certain corporate characteristics (size, profitability leverage etc.), governance characteristics (Board size, Environmental committee etc.) as being behind the voluntary disclosures.

Criterion validity measures how well an instrument compares against another instrument of predictor and is determined through correlation coefficients (Litwin, 1995). Generally high correlation coefficients are considered a signal for instrument suitability. Criterion validity concerns both concurrent validity (correlation between a measure and the criterion at the same time) and predictive validity (correlation between a future criterion and the relevant measure). Botosan (1997) used the AIMR scores, number of wall street journal articles about a firm and the number of analysts following the firm to compute correlations with her self-constructed index as a way of determining criterion validity. However as Hassan and Marston (2010) observed, criterion validity is difficult to be tested in most social science studies since most measures represent theoretical constructs of which there is no generally accepted criteria to compare. In this study focussing on GHG disclosures which is fairly recent and highly divisive in terms of the scientific background, it was noted that there was no known available criteria that could suit the sample to enable the researcher carry out a criterion validity test as such it was not done.

After ensuring both the reliability of coding through the test sample by five researchers and the validation of the instrument, the researcher proceeded to code and scores all reports by himself to ensure consistency. The annual and sustainability reports scored during the pilot phase were also scored again together with other companies. This was carefully done by adhering to the set decision rules. Despite the rigorous process undertaken in this study, recognition is made that the use of content analysis in general is far from perfect as it is still prone to subjectivity. The use of independent experts and decision rules is meant to limit the level of subjectivity.

7.9 Statistical Tests Performed to ensure Appropriateness of Data

When testing hypotheses about a population using multiple models then it is advisable that the random sample should satisfy four assumptions which are as follows: the observations are independent; there should be a linear relationship between the dependent and independent variables; Homoscedasticity i.e. for each of the independent variables, there must be a normal distribution of values of the dependent variable and; the distributions should have one

variance (Norusis 2004). He further suggested usage of non-parametric tests if any of these assumptions are violated.

Generally researchers agree that the larger the sample the high the probability of satisfying these assumptions. As a rule of thumb a sample of more than 30 observations is assumed to satisfy these assumptions (Field, 2009). The sample of 215 firms which over a four year period translates to 860 firm observations is considered sufficient to enable a robust empirical analysis. The sample compares favourably to prior studies on GHG disclosures like Freedman and Jaggi (2005), 120 firms; Prado-Lorenzo et al. (2009), 101 firms and Rankin et al. (2011) 80 firms.

A number of parametric statistical tests including descriptive statistics, Pearson and Spearman correlations and Ordinary Least Squares (OLS) multiple regression have been undertaken using STATA 12. Data have been panelled according to time i.e. four years. In addition, a pooled OLS regression was performed to provide a comparative basis to the panel regression since it deals with data as one unit with same distribution error unlike panel data regression. Three confidence intervals of 99%, 95% and 90% are used in the analysis.

7.9.1 Econometric Modelling

Due to the nature of the data the study employed two techniques. The first level of modelling used Ordinary Least Squares (OLS) regression. The initial model used was estimated as below:

$$\text{GHG DIS}_x = \beta_0 + \beta_1\text{BOARDSIZE}_x + \beta_2\text{NEDRATIO}_x + \beta_3\text{Envirocomm}_x + \beta_4\text{Auditcom}_x \beta_5\text{DOWN}_x + \beta_6\text{OWCON}_x + \beta_7\ \text{Size}_x + \beta_8\text{Profitability}_x + \beta_9\text{Gearing}_x + \beta_{10}\ \text{Liquidity}_x + \beta_{11}\ \text{Industry}_x + \varepsilon$$

Where;

GHG DIS_x is the Greenhouse Gas emissions disclosure index obtained after analysing company x's annual report;

BOARDSIZE_x is the number of people making up the board committee of company x.

NEDRATIO_x is company x's ratio of Non-Executive Directors on the board;

Envirocomm_x represents presence of board environmental committee and is a dummy i.e. 1 if available or otherwise 0.

Auditcom_x is the size of Audit committee in relation to total number of board members of company x.

DOWN_x is proportion of shares held by directors of the company;

OWCON_x is proportion of shareholding by shareholders with 3 per cent or more;

$Size_x$ is company x's variable related to corporate size;

$Profitability_x$ is company x's variable representing profitability e.g. profit after tax;

$Gearing_x$ is company x's gearing/leverage, established as the ratio between total debt and stockholders' equity;

$Liquidity_x$ is company x's variable representing liquidity e.g. Current assets divided by current liabilities;

$B_{1\text{-}11}$ Coefficients

ε Residual

β_0 Constant

The second level stage involved panel data techniques. In a panel data set like our sample, panel data techniques help to capture variation across different agents in space and changes emerging over time (Inchausti 1997; Baltagi 1995). More importantly it enables the researcher to take into account omitted or unobserved variables. Unobserved heterogeneity existing among companies can also be controlled in panel data sets. The static model of panel data is as follows:

The equation for the fixed effects model becomes:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it} \qquad \textbf{[equ.1]}$$

Where

– α_i (i=1….n) is the unknown intercept for each entity (n entity-specific intercepts).

– Y_{it} is the dependent variable (DV) where i = entity and t = time.

– X_{it} represents one independent variable (IV),

– β_1 is the coefficient for that IV,

– u_{it} is the error term

The rationale for this model is that if unobserved variable does not change over time then any changes in the dependent variable could be due to influences other than these fixed characteristics [39].

The fixed effects model can also be estimated using binary variables. So the equation for the fixed effects model becomes:

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \ldots + \beta_k X_{k,it} + \gamma_2 E_2 + \ldots + \gamma_n E_n + u_{it} \qquad \textbf{[equ.2]}$$

Where

–Y_{it} is the dependent variable (DV) where i = entity and t = time.

–X_k,it represents independent variables (IV),

–β_k is the coefficient for the IVs,

–u_{it} is the error term

–E_n is the entity n. Since they are binary (dummies) you have n-1 entities included in the model.

–γ_2 is the coefficient for the binary repressors (entities)

Both eq.1 and eq.2 are similar

When both time and firm effects are included in the same model i.e. double fixed effects then the model is estimated as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \ldots + \beta_k X_{k,it} + \gamma_2 E_2 + \ldots + \gamma_n E_n + \delta_2 T_2 + \ldots + \delta_t T_t + u_{it} \quad \textbf{[equ.3]}$$

Where

– Y_{it} is the dependent variable (DV) where i = entity and t = time.

– X_1, represents independent variables (IV),

–β_k is the coefficient for the IVs,

– u_{it} is the error term

–E_n is the entity n. Since they are binary (dummies) you have n-1 entities included in the model.

– γ_2 is the coefficient for the binary regressors (entities) .

–T_t is time as binary variable (dummy), so we have t-1 time periods.

–δ_t is the coefficient for the binary time regressors.

The equations are based on the work of Stock and Watson (2003).

In using panel data, the researcher must decide whether to employ a fixed or random effects model. The random effects model assumes a single common intercept term, and that the intercepts for individual companies vary from this common intercept in a random manner; the fixed effects model assumes different intercept for individual companies (Stock and Watson, 2003). In order to choose the appropriate model, both the fixed effects and random effects estimators were used to estimate the co-efficients in the model below. Then the Hausman test was performed, which rejected the null hypothesis that the unobserved heterogeneity is uncorrelated with the regressors. This finding meant that the random and the

fixed effects were significantly different, and that the fixed effects was the more consistent and efficient one to use. The following model was tested;

$$Y_{it} = \alpha_i + \beta^{bs}.x^{bs}_{it} + \beta^{ned}.x^{ned}_{it} + \beta^{aud}.x^{aud}_{it} + \beta^{evc}.x^{evc}_{it} + \beta^{ow}.x^{ow}_{it} + \beta^{do}.x^{do}_{it}\ \beta^{s}.x^{s}_{it} + \beta^{roa}.x^{roa}_{it} + \beta^{gea}.x^{gea}_{it} + + \beta^{liq}.x^{liq}_{it} + \beta^{ind}.x^{ind}_{it} + \sum_{t=1}^{4}\alpha_t + \mu_{it}$$

where *i* is 1,……215, *t* is 1(2008), 2(2009), 3(2010), 4 (2011), x^{bs} is board size, x^{ned} is proportion of Non-Executive Directors, x^{aud} is Audit Committee, x^{evc} is Board Environmental Committee, x^{ow} is owcon, x^{do} is down, x^{s} is logta, x^{roa} is profitability, x^{gea} is gearing, x^{liq} is liquidity, x^{ind} is industry and α_t are intercept variables that vary from year to year. They capture the difference between years assuming the individual sample members are homogeneous. This model helps to analyse whether the change in GHG disclosures was largely due to the company characteristics identified or events happening in between time periods (introduction of Climate Change Act 2008) or both influenced the disclosures.

7.9.2 Outliers

The study carefully scrutinised the existence of outliers so as to ensure that the regression is not significantly influenced by any such cases. The regression was run twice with the first preliminary trial aiming at identifying outliers. The basis of judgement was the work of Field (2009) who suggested that outliers could be identified by monitoring among other things Standardised Residuals, Values of Cook's distance and Mahalanobis distance. Thus according to Field (2009), any cases with standardised residual values of above 3 could be an outlier and again any case whose Cook's Distance value is above 1 is deemed to have influence on the regression. Similarly a crude check on Mahalanobis distance value of above 15 for smaller samples indicates presence of outliers. In this study no case was found to be in violation of these conditions hence the results can be seen in light of no bias by any influential case.

7.9.3 Multi-Collinearity

Multicollinearity in independent/predictor variables has been reviewed by analysing correlation factors and Variable Inflation Factors (VIF) in line with the work of Weisberg (1985). Preliminary results indicated that the highest simple correlation between independent variables was 0.47 between Audit committee and Board size. Bryman and Cramer (1997) and

Field (2009) suggest that simple correlation between independent variables should not be considered harmful unless they exceed 0.8. or 0.90. In terms of VIF, Field (2009) highlights that VIF greater than 10 should be considered a signal of harmful multicollinearity. Alternatively Bowerman and O'Connell (1990) explain that an average VIF which is significantly greater than 1 may suggest that the regression is biased. The average VIF is 2.57 when the nine industry dummies are included while their exclusion sees the VIF mean dropping to 1.4. This suggests inclusion of the industry dummies may potentially result in multicollinearity problems. In view of this the final regression model will ensure multicollinearity is controlled for by use of robust and also transforming the industry variables into one dummy.

7.10 Survey Questionnaire

The third objective of the study i.e. investigating the motivation/determinants behind voluntary GHG disclosure in practice was addressed through a survey questionnaire. Survey questionnaire method is widely used in social sciences for understanding the characteristics and interrelations of sociological and psychological variables (Roberts, 1999). In fact Hussey and Hussey (1997) argued that individual perspectives or opinion on a particular subject matter can either be examined by a questionnaire or interview. In this respect the study seeks to establish GHG information preparers' opinions about their motivation in disclosing such information voluntarily hence the survey method is considered appropriate. Information collected in this manner is meant to enhance the understanding of GHG disclosures derived from secondary data inferences. This is therefore an explanatory survey which is meant to test/confirm hypotheses derived from theory (May, 2001).

The use of the survey method has a number of advantages. It can enable the researcher to collect information from very large proportion of the population which offers a firm basis for generalizability (Graham et al., 2005). However there are some criticisms against the use of surveys one of which is that questions/responses can be taken out of context and data derived from the same cannot justifiably be used to identify causal relationships. In addition, others also argue that in cases where the motivation of the researcher in using the survey methodology is not clear, then outcome is shrouded in certainty (de Vaus, 2002). In this study the focus is not on establishing causal relationships and the researcher has used a carefully designed and administered form of questionnaire based on prior literature to limit bias emanating from unclear motives.

The survey method generally involves a questionnaire. According to Collis & Hussey

(2003, p. 173), a questionnaire is "*a list of carefully structured questions, chosen after considerable testing with a view to eliciting reliable responses from chosen sample. The aim is to find out what a selected group of participants do, think or feel*".

A survey questionnaire is considered to be a more flexible tool than other methods and that if administered properly, it gives a degree of freedom to the respondents. A questionnaire can be administered through a number of ways ranging from telephone interview survey, internet survey, face-to-face interview survey, and to self-completion mailed survey (Thomas, 2004). Each of the option has strengths and weaknesses. For instance while the self-completion mailed survey is appropriate for large dispersed groups and cost effective, it is synonymous with a low response rate (Forza, 2002). In contrast, the face to face interview often results in high response rates but is not appropriate and cost effective with large dispersed groups. The internet is generally considered medium to high in terms of response rates and quality for any size while the telephone is generally high in similar categories (Forza, 2002; Thomas, 2004). In this study, a self-completion mail survey was adopted on the basis of cost effectiveness (time and money) and the convenience it gives on the part of the respondent (Forza, 2002). Target participants in this survey (finance directors) are often busy as such it was felt that a survey questionnaire which they can complete at their convenience would suit them well. Survey questionnaires were sent through both postage and emails beginning with the former and then the latter during reminders of those who did not respond in the first instance.

Nonetheless it is appreciated that by adopting the mail option, the study was prone to many of the weaknesses associated with this method. In particular mail surveys are prone to low response or inappropriate responses in cases where the respondents have misunderstood the true meaning of the statements (Thomas, 2004). Low response rates are major concern when considering results generalizability while inappropriate responses may lead to inappropriate responses. As mentioned, a reminder was sent to help improve the response rates but again the questionnaires were accompanied by a separate letter explaining the importance of the study and the need for the company participation (see appendix I) Both in the letter and the introduction part of the actual questionnaire, participants were assured of anonymity and confidentiality to increase the chances of responses. A pre-stamped self-addressed envelope and a writing pen were provided with each questionnaire to facilitate its return. More importantly, participants were advised to write down their contact addresses if they wanted a copy of the final report. Thomas (2004) considers such an offer as an incentive

that can boost response rates. The issue of getting inappropriate responses due to lack of clarity in survey questions was addressed through a proper design of the questionnaire.

7.10.1 Questionnaire Design

Questionnaire designing is one of the critical elements that can directly impact on the validity and reliability of data collected and response rates (Saunders et al., 2009). Thus question validity determines the accuracy of data collected whereas the question reliability ensures that data is collected consistently (Forza, 2002). In all what is important is that questions are understood by respondents in the way intended by researcher and that answers are understood by researcher in the way intended by respondent (Foddy, 1994). In order to achieve question validity and reliability and attract high response rates, researchers are advised to ensure that a number of issues like appearance, layout, length and even the colour of the paper used are properly addressed (Ghauri and Gronhaug, 2002). Although guidelines for designing a questionnaire may differ depending on authors (see Ghauri and Gronhaug 2002 who suggested 12 guidelines and Thomas, 2004 who had 11), they all agree that a well-designed questionnaire should be visually attractive, look short, look interesting, be easy to complete, and be easy to return. In this study, while following guidelines available, extensive review of GHG and other disclosure literature was carried out so as to ensure that questions were determined by data to be collected.

Since GHG disclosure studies are few and none according to the researcher has attempted to collect primary data, the list of determinants included in the question used here was adapted from both environmental and GHG disclosure studies (Freedman and Jaggi, 2005; Berthelot and Robert, 2012; Rankin et al., 2011; Stanny and Ely, 2008; Wilmhurst and Frost 2000; Clarkson et al., 2008; Cormier et al., 2004 etc.). The use of adapted or adopted questions (in this case, determinants) is highly recommended in literature where the researcher intends to replicate or compare findings with another study (Saunders et al., 2009). Since to a larger extent this study intends to confirm whether generally accepted theoretical explanations for voluntary disclosures are the same in practice then the choice of adapted questions or list of determinants is considered appropriate.

Despite this however, caution was exercised when choosing the work to be adapted by considering the quality of the work to be adapted and the nature of questions. Generally there are two forms in which questions can be constructed namely open questions (which allow respondents to give answers in their own way and closed questions (which provide a number of alternative answers from which a respondent is instructed to choose). Either has its own

weaknesses and strengths but the closed questions is deemed quicker and easier to respond which may increase response rates (de Vaus, 2002; Dillman, 2000). Some of its weaknesses include lack of response variety and depth and the possibility of investigator bias which emerge when the researcher includes the only response options he likes (Kumar, 1999; de Vaus, 2002). The adapted work in this study used closed questions on a Likert-style rating scale. The main question was pre-coded on a scale of 1 to 5. The limitations of the closed questions have been minimised by the fact that the researcher uses response options which have been tried and tested before. Enough space was also provided to those who wanted to provide further explanations to their responses which aimed at enhancing the variety of the responses (see appendix I for a copy of the questionnaire).

7.10.2 Questionnaire Content

The questionnaire started with a few instructions advising participants of their confidentiality and the manner in which the responses are to be given. Thereafter it was structured into two different sections as follows:

Section A: Background information. This had three sub-sections. The first sub-section asked respondents to provide personal background, such as gender, age, name of their company and position they hold, length of period on position and their qualification. The second sub-section requested information on Chief Executive Officer (age, time in role and their qualifications). The last sub-section sought company background relating to revenue/turnover and number of employees. The company and CEO characteristics were selected based on prior literature on disclosures which suggests that differences in some governance and corporate characteristics might influence disclosure.

Section B: Determinants of voluntary GHG disclosures

This section contained question 1 which had 12 items of various corporate governance and general company characteristics and participants were asked the extent to which they agreed or disagreed that the characteristics influence voluntary disclosures.

7.10.3 Pilot Testing

It is advisable that before the questionnaire is used in the research it should be pilot tested. The pilot testing is meant to refine the questionnaire so that respondents will have no problems answering and that problems in data recording are minimised (Saunders et al., 2003; Forza 2002). Pilot testing also help improve the reliability and validity of the

questionnaire (Roberts, 1999). Thomas (2004) argued that feedback obtained from pilot testing however small it may be is extremely important in shaping the final outcome of the questionnaire. To ensure content validity, Mitchell (1996) advises that at the very initial stages of the questionnaire development, it should be assessed by experts in the subject matter who will comment on both the suitability of the questionnaire to bring required data and structure. In fact according to Zikmund (2000), two pre-testing procedures can be done namely screening the questionnaire with other experts and having a trial run. In this research both procedures were followed including a further third procedure. To begin with, the researcher developed the questionnaire and it was initially reviewed by the two project supervisors. After incorporating their initial comments the draft questionnaire was also scrutinised by two independent academics with considerable experience in survey designs from another department and a group of three PhD students. Comments from these people mainly centred on instrument clarity and design and the time taken to complete the same. Once their comments were incorporated, the draft version was again reviewed by the two supervisors involved in the project to ensure that subject specific contents have not been marginalised with advice obtained from the others. Modifications arising from this process related to the wording and scaling of certain questions which resulted in the questionnaire being shortened, complex questions deleted and sensitive questions reworded. After this process the questionnaire was used in the pilot study which involved 76 companies. No major modifications were made after the pilot study (see appendix I for the final version used in the study).

7.10.4 Ethical consideration

Research involving human participants is required to have ethical clearance as way of ensuring the confidentiality and well-being of the respondents (Converse and Presser, 1986). In this study, all ethical clearance procedures of the university were followed. An ethical clearance form was completed at the beginning of the project and was submitted for approval by the University's Research Ethics committee. Overall, the research was classified as of no risk to the participants. In the letter accompanying the questionnaires, participants were also assured of their confidentiality.

7.10.5 Questionnaire administration and sample

The questionnaire was addressed to the finance directors of 215firms and stamped-addressed envelopes were enclosed for their replies. Non-respondents were followed up three times,

through email, telephone and a second letter containing a copy of the questionnaire. This resulted in 69 firms responding; 62 responses were usable (i.e., all questions were completed), representing a 28.8 per cent response rate, which compared favourably with previous studies. For example, Beattie and Smith (2012) reported a response rate of 9.3 per cent, while Verma and Dewe (2004) had a 5.8 per cent response rate. Though our response rate compares favourably to prior studies, we reckon that it is still a low response rate. Baruch (1999) argued that in itself a response rate is meaningless rather the necessity and difficulty lies in explaining the low response rates. In this study, the low response rate could be attributed to a number of reasons. Our target group, the listed companies' directors are among the difficult group to target in a survey questionnaire due to their busy schedules. Ten of the companies that declined to take part sent emails through their directors' personal assistants stating that their finance directors were too busy to participate in our survey.

Beattie and Smith (2012) noted that due to the nature of this group, a response rate of between 10 and 20 per cent is considered appropriate or sufficient. The other reason could be the subject matter which is considered topical and sensitive. While non-response rates might be peculiar to certain firm characteristics i.e. size and industry, Verma and Dewe (2004) argue that it may also mean that those who did not respond did not value the subject matter and that in itself is a finding. Therefore, in our case, we consider the low response rate to be a reflection of the sensitivity surrounding climate change.

The responding firms and a sample of those that did not respond were subjected to non-response bias tests to determine the representativeness of respondents. In particular, a two-tailed *t*-test was performed using the mean turnover and number of employees of the initial sample and the responding firms; the outcome was not statistically significant. In line with prior studies (Darnall *et al.*, 2010), we also ensured that our survey was free from a social-desirability bias. This was achieved by ensuring that all respondents were informed of their anonymity and was unaware that their responses would be compared with actual disclosure in annual and sustainability reports. One characteristic of social-desirability bias is that there is less variability in responses, which could affect the statistical significance of the results.

The analysis was in large part based on descriptive statistics. In addition, apart from ranking based on mean, based on prior literature (Graham *et al.*, 2005; Nauman and Giel, 1995), a modified top two box and bottom two box scores were used to explore the pattern of the responses. Using this approach, the original five point scale in the surveys was collapsed

to increase the clarity of the data for reporting purposes. Scales were collapsed into "bottom two box" and "top two box" scores. Bottom two box scores represented the percentage of respondents who selected responses that were considered negative i.e. disagree or strongly disagree, taken from the bottom portion of the five point scale. The top two scores represent the percentage of respondents who selected responses that were considered positive i.e. agree or strongly agree. The middle column which referred to neutrality formed its own group. Thereafter the summarized results were subjected to a *t*-test between the mean score of each item and its neutral score.

7.11 Summary

This chapter discussed the research philosophy/paradigms, methods, sample and data as well as analysis techniques to be used to achieve the set objective of the study. The chapter has also discussed at length the reliability and validity assessment applied to the disclosure instrument used in this study both during construction and its use. Steps undertaken to design and implement the survey questionnaire have also been explained.

The study is positivist and deductive in nature but it also has limited inclination towards interpretivist through its use of survey questionnaire. The research will largely use secondary quantitative data and test a series of hypotheses in order to achieve the first two objectives. This data set will be extracted from annual, sustainability and website reports of a sample of FTSE350 companies listed on LSE in the period 2008-2011. The analysis uses a research index methodology in which the extent of disclosure is measured by comparing the disclosed information with a set of required disclosures by the various reporting frameworks.

CHAPTER EIGHT

Results and Analysis

8.0 Introduction

This chapter explores the nature and relationships of variables in our models as specified in the preceding chapter and goes further to report and analyse the results of our modelling in a bid to address the research objectives. It begins by discussing the descriptive statistics of the variables in the model so as to ensure that statistical assumptions underpinned by our final model are adhered to. Thereafter results of regression analysis used to test the hypotheses as presented in Chapter 6 are presented and discussed. Results are discussed in light of both empirical and theoretical framework literature as presented in Chapters 2 and 5 respectively. The final part discusses the results of the secondary data modelling in light of the insights obtained from the survey questionnaire responses.

8.1 Descriptive Statistics

Tables 8 and 9 present detailed descriptive statistics for the disclosures.

Table 8: Consolidated Disclosure Scores for all industries

	Disclosure item	2008		2009		2010		2011	
		Absolute Freq.	Relative (%)	Absolute Freq.	Relative (%)	Absolute Freq.	Relative (%)	Absolute Freq.	Relative (%)
	Qualitative Disclosures								
1	Institutional background	206	95%	213	99%	213	99%	213	99%
2	Period covered by the report	203	94%	212	98%	212	98%	212	98%
3	Statement on company position on climate change and related responsibilities	190	88%	200	93%	203	94%	202	94%
4	Corporate governance on climate change	165	76%	182	84%	187	87%	191	88%
5	Climate change opportunities and company strategies	110	51%	126	58%	138	64%	137	63%
6	Climate change impact on business operations including supply chains	80	37%	95	44%	105	49%	111	51%
7	Identification of regulatory risks as a result of climate change	40	19%	53	25%	61	28%	67	31%
8	Identification of all other risks as a result of climate change	54	25%	64	30%	78	36%	92	43%
9	Actions/measures taken to reduce/mitigate climate change impact	183	85%	203	94%	206	95%	207	96%
10	Adaptation strategies to climate change effects	77	36%	96	44%	101	47%	103	48%
11	Regulated Schemes to which a firm belongs	31	14%	58	27%	73	34%	79	37%
12	Reporting Guidelines used in GHG reporting	84	39%	112	52%	132	61%	135	63%
13	An assurance statement on disclosed information	35	16%	45	21%	53	25%	58	27%
14	Contact or responsible person for GHG reporting	113	52%	138	64%	155	72%	163	75%
15	Organisation boundary and consolidation approach	65	30%	77	36%	89	41%	98	45%
16	Base Year	77	36%	92	43%	111	51%	126	58%
17	Explanation for a change in base year	40	19%	51	24%	59	27%	69	32%
18	GHGs covered including those not required by Kyoto protocol	44	20%	58	27%	62	29%	68	31%

19	Sources and sinks used/excluded	51	24%	64	30%	74	34%	88	41%
20	Conversion factors used/methodology used to measure or calculate emissions	40	19%	58	27%	70	32%	83	38%
21	Explanation for any changes to methodology or conversion factors previously used	31	14%	43	20%	59	27%	64	30%
22	A list of facilities included in the inventory for GHG emissions	16	7%	23	11%	29	13%	37	17%
23	Information on the quality of the inventory e.g. causes and magnitude of uncertainties in estimates	2	1%	5	2%	9	4%	13	6%
24	Information on any GHG sequestration	18	8%	29	13%	37	17%	37	17%
25	Disclosure of the supplier and the name of the purchased green tariff	8	4%	8	4%	11	5%	13	6%
26	Explanations for changes in performance of total GHG emissions in Co2 metric tonnes	100	46%	126	58%	141	65%	154	71%
27	Explanation of any country excluded if global total is reported	75	35%	93	43%	106	49%	111	51%
28	Explanations for changes in performance of scope 1 emissions	35	16%	49	23%	60	28%	69	32%
29	Details of any specific exclusion of emissions from scope 1	22	10%	34	16%	50	23%	55	25%
30	Explanation for the reason of any exclusion from scope 1	18	8%	29	13%	40	19%	45	21%
31	Explanations for changes in performance of scope 2 emissions	34	16%	48	22%	58	27%	65	30%
32	Details of any specific exclusion of emissions from scope 2	22	10%	34	16%	49	23%	53	25%
33	Explanation for the reason of any exclusion from scope 2	18	8%	29	13%	39	18%	44	20%
34	Explanations for changes in performance of scope 3 emissions	23	11%	35	16%	48	22%	59	27%
	Quantitative Disclosures								
35	Total GHG emissions in Co2 metric tonnes	117	54%	138	64%	154	71%	170	79%
36	Comparative data of Total GHG emissions in Co2 metric tonnes	103	48%	125	58%	142	66%	159	74%
37	Future estimates of total GHG emissions in Co2 metric tonnes	10	5%	13	6%	13	6%	15	7%
38	GHG emission by business unit/type/country	75	35%	90	42%	108	50%	123	57%

39	GHG removals quantified in tonnes of Co2e	23	11%	29	13%	36	17%	43	20%
40	Scope 1 emissions	28	13%	41	19%	54	25%	63	29%
41	Comparative data on scope 1 emissions	20	9%	32	15%	47	22%	56	26%
42	Future estimates of scope 1 emissions	1	0%	2	1%	3	1%	3	1%
43	Scope 2 emissions	28	13%	40	19%	53	25%	62	29%
44	Comparative data on scope 2 emissions	20	9%	32	15%	46	21%	54	25%
45	Future estimates of scope 2 emissions	1	0%	2	1%	3	1%	5	2%
46	Scope 3 emissions	18	8%	29	13%	39	18%	50	23%
47	Comparative data on scope 3 emissions	14	6%	24	11%	36	17%	45	21%
48	Future estimates of scope 3 emissions	1	0%	2	1%	3	1%	3	1%
49	Emission of direct Co2 reported separately from scopes	60	28%	68	31%	81	38%	95	44%
50	Emission not covered by Kyoto and reported separately from scopes	57	26%	67	31%	83	38%	95	44%
51	Emission attributable to own generation of electricity/heat/steam sold or transferred to another organ.	81	38%	93	43%	103	48%	116	54%
52	Emission attributable to own generation of electricity/heat/steam purchased for resale to end users	36	17%	48	22%	54	25%	63	29%
53	For purchased green tariff state the reduction in tonnes of Co2e per year	7	3%	13	6%	16	7%	17	8%
54	Additional carbon saving associated with the tariff as a percentage	2	1%	6	3%	6	3%	5	2%
55	Quantitative data estimates of the regulatory risks as a result of climate change	1	0%	1	0%	1	0%	1	0%
56	Quantitative data estimates of all other risks as a result of climate change	1	0%	1	0%	1	0%	2	1%
57	GHG emission performance measurement against internal and external benchmarks including ratios	57	26%	79	37%	89	41%	105	49%
58	GHG emission targets set and achieved	82	38%	108	50%	122	56%	139	64%
59	GHG emission offsets information	26	12%	33	15%	39	18%	48	22%

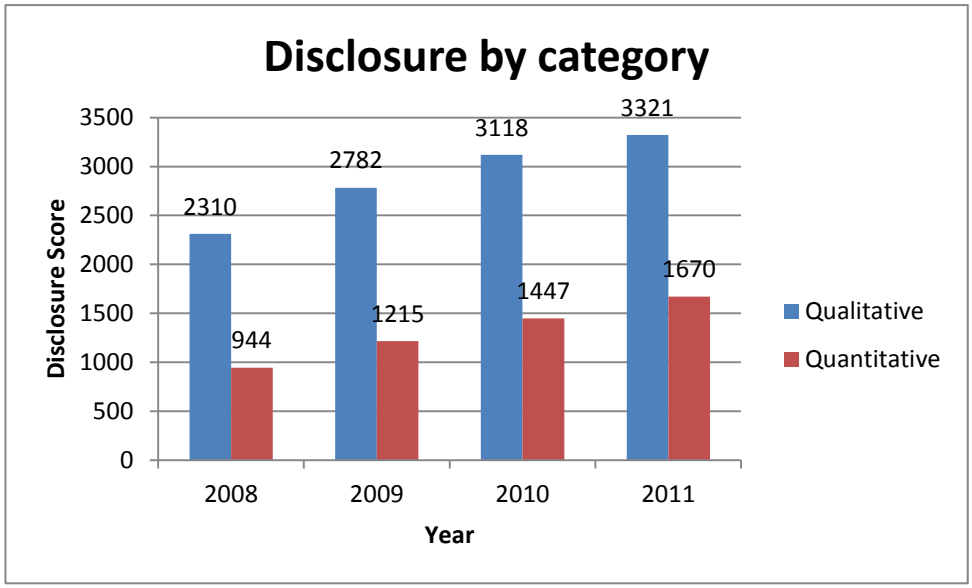
60	Comparative information on targets set and achieved	75	35%	99	46%	115	53%	133	62%		

Table 9: Summary GHG disclosure scores per year

	2008			2009			2010			2011		
Type of disclosure	**All firms Score**	**Max. poss. score***	**% of score**	**All firms Score**	**Max. poss. score***	**% of score**	**All firms score**	**Max. poss. score***	**% of score**	**All firms score**	**Max. poss. score***	**% of score**
Qualitative disclosures	2310	7344	31%	2782	7344	38%	3118	7344	42%	3321	7344	45%
Quantitative disclosures	944	5616	17%	1215	5616	22%	1447	5616	26%	1670	5616	30%
Total GHG disclosure score	3254	12960	25%	3997	12960	31%	4565	12960	35%	4991	12960	39%

** Maximum possible score is derived by multiplying total number of firms and total disclosure items available per category*

There was a wide variety of information in the disclosures ranging from policy statements on climate change, governance structures relating to climate change, risk assessment arising from climate change, reporting frameworks adopted, quantitative emission data, to future plans and targets on carbon emissions. A review of the disclosures indicates that overall, more qualitative disclosures are made compared to quantitative ones. For instance in 2008, the firms disclosed about 31 per cent of all available qualitative disclosures against just 18 per cent of the available quantitative disclosures (See table 9 above and chart 1 below).

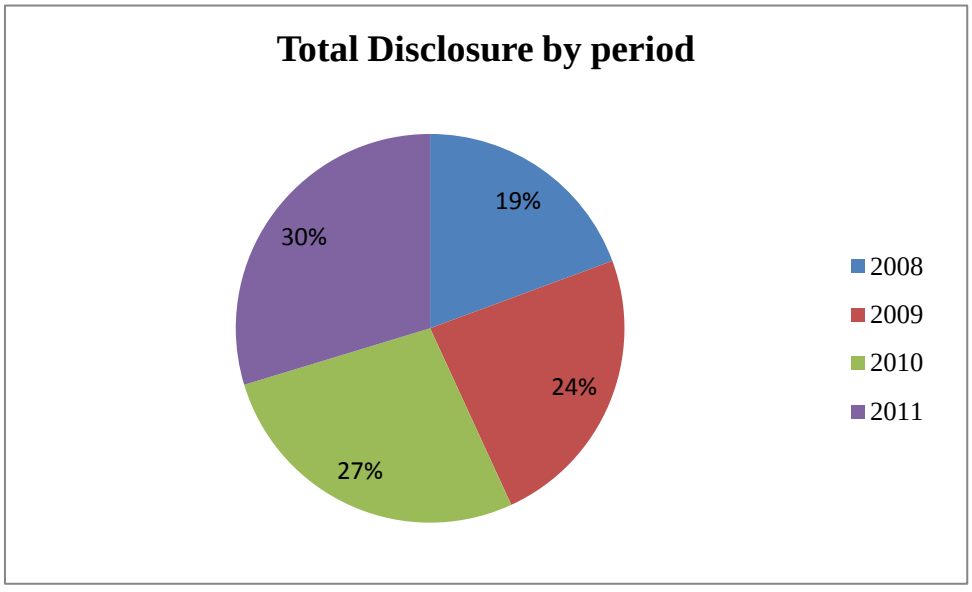


However over the period, firms have progressively increased their level of quantitative disclosures reporting about 31 per cent of the items in 2011 against 18 per cent in 2008. On the qualitative disclosures, the most frequently reported item was the actions/measures taken to reduce/mitigate climate change impact with almost 95 per cent of the firms reporting it in 2011 (See table 9 above). This could suggest desire on the part of the companies to shift focus of their target audience from their actual impact on climate change to intended actions on the same. The least disclosed qualitative information in all the years was the disclosure of supplier and the name of the purchased green tariff. The number of firms disclosing their reporting framework guidelines has also increased from 49 per cent in 2008 to 71 per cent in 2011. Over the same period, there has been a marginal increase in the number of firms obtaining assurance services on their GHG emissions reporting from 25 per cent in 2008 to 38 per cent in 2011. This could imply unwillingness on the part of the

companies to dedicate resources in improving the quality of their GHG reporting. As argued by Hrasky (2012) companies have now resorted to mere symbolism in terms of carbon disclosure hence the need for government intervention to improve the quality of disclosures.

The frequently reported quantitative item in all the years under review was the total GHG emissions in Co_2 metric tonnes which were reported by 84 per cent of the firms in 2011. However over the same period, evidence indicates low levels of GHG quantitative disclosure per scopes. For instance only 13 per cent of the firms reported their GHG emissions per scope 1 in 2008 and by 2011 the figure had risen to only 29 per cent. A similar finding was recorded by Dragomir (2012) who noted that a sample of companies comprising BP, Total, Shell, BG Group and Eni had largely disclosed GHG emissions in total rather than in scopes. Overall there was lack of quantitative information relating to future estimates of emissions and quantifiable estimates of regulatory risks arising from climate change. This reflects the findings of Haque and Deegan (2010) who noted Australian companies GHG emissions disclosures had provided only limited insights into climate change risks and opportunities. This could arguably imply failure on the part of the firms to fully integrate GHG reporting to the other parts of the business. Kolk et al. (2008) reported that in general, their sampled firms GHG disclosures had demonstrated no link among strategy, performance and GHG emissions which meant lack of GHG integration into mainstream business strategies. Stanny (2011) interpreted the lack of firm efforts to improve quality of disclosures as confirmation of legitimacy theory arguing that in this respect firms only disclose the minimum possible just to meet minimum stakeholder needs.

Evidently there was also a remarkable increase in the disclosures from 2008 to 2011. Refer to chart 2 below.



From chart 2, the extent of disclosure has moved from just 19% in 2008 to about 30% in 2011. Overall, the volume of disclosures increased from a mean disclosure score of 15.0 in 2008 to a mean disclosure score of 23.3 in 2011. While there is marginal increase between 2010 and 2011 (about 8.1 per cent), a significant increase is recorded between 2008 and 2009 and 2009 and 2010 (about 16.1 per cent and 16.5 per cent respectively). In addition it was noted that the disclosure pattern of firms in 2011 was to a large extent a repetition of what was disclosed in 2010.This could partly imply a positive response to the introduction of both the Climate Change Act in 2008 and DEFRA guidelines on measurement and reporting in 2009. About 14.5 per cent of the sampled companies disclosed the use of DEFRA (2009) in compiling and reporting their information.

8.1.1 Descriptive Statistics: Dependent and Independent variables

The pooled data (2008–2011) descriptive statistics of both dependent and independent variables are presented in table 10 below.

Table 10: Descriptive Statistics - Aggregate 2008-2011

Variables	Mean	Std dev.	Min	Max	Skewness	Kurtosis
Disclosures - All	0.3245	0.2236	0	0.8833	0.6606	2.3707
Qualitative Disclosure	0.392	0.2352	0.000	1.000	0.638	2.437
Quantitative Disclosure	0.2358	0.225	0.000	1.000	0.665	2.367
Board Size	9.1891	2.6182	4	31	1.4347	8.7902
Non-Executive Director	0.6515	0.1118	0.2857	0.9285	-0.2629	2.7461
Environ. Committee	0.0729	0.26	0.000	1.000	3.285	11.793
Audit Committee	0.4038	0.0972	0	0.8	0.2594	3.3753
Ownership Concentra.	40.2311	17.8013	3.55	91.47	0.1689	2.4692
Director Ownership	5.4573	13.2501	0	85.37282	2.9868	11.5893
Size	7.6374	1.5519	3.6888	12.752	0.6425	3.4497
Profitability	8.9738	11.5724	-84.6	120.388	1.1108	30.3831
Gearing	1.5219	12.5195	0.0208	246.2383	15.4521	255.2499
Liquidity	1.6165	1.7014	0.1858	27.2794	7.4616	90.2653

These results indicate that companies' GHG scores ranged from 0 to 88.3 per cent, but that overall the mean disclosure for the four years is 32.45 per cent, an indication that the extent of GHG disclosures by FTSE 350 companies is still low. When categorised into two as

qualitative and quantitative, the disclosures have a similar pattern to overall disclosures with each having a mean of 0.39 and 0.23 respectively.

The descriptive statistics for the continuous independent variables indicate that the mean board size was about nine directors, with a minimum of four and maximum of 31. In the same period, the audit committee size has ranged from 2 to 8. The companies had low levels of director ownership (as indicated by a mean of 5.46 per cent) and moderate levels of ownership concentration (as suggested by the mean of 40.23 per cent over the four-year period). In fact director share ownership ranged from 0 to 64.4 per cent in 2008 and this remained relatively constant over the period while for ownership concentration, the maximum was above 80 per cent over the same period. Refer to table 11 below;

Table 11: Descriptive Statistics

2008							2009					
Variables	**Mean**	**Std dev.**	**Min**	**Max**	**Skewness**	**Kurtosis**	**Mean**	**Std dev.**	**Min**	**Max**	**Skewness**	**Kurtosis**
Disclosures - All	0.252	0.198	0	0.783	0.935	2.988	0.308	0.217	0	0.85	0.743	2.444
Qualitative Dis	0.314	0.211	0.000	0.941	0.849	2.922	0.378	0.2299	0.000	0.941	0.730	2.494
Quantitative Dis	0.1711	0.1975	0.000	0.692	1.023	3.069	0.2165	0.2168	0.000	0.731	0.716	2.344
Board Size	9.251	2.606	5	19	0.829	3.896	9.287	2.966	4	31	2.378	15.717
Non-Exec.	0.641	0.118	0.285	0.923	-0.319	2.841	0.642	0.113	0.311	0.928	-0.151	2.69
Environ. Commit.	0.069	0.254	0	1	3.387	12.475	0.069	0.254	0	1	0.254	12.474
Audit Committee	3.516	0.879	2	7	1.023	4.851	3.516	0.879	2	7	1.02	4.851
Director Own.	5.782	13.363	0	64.404	2.784	10.145	5.797	14.014	0	85.372	3.087	12.68
Ownership Conc.	39.878	18.447	3.59	91.47	0.19	2.58	39.862	17.548	3.98	87.82	0.253	2.612
Size	8645.5	28093.63	40	282401	7.13	61.609	9064.76	29771.94	53.7	292181	6.871	57.171
Gearing	1.846	16.772	0.02	246.24	14.491	211.63	1.296	9.479	0.025	139.243	14.436	210.5
Profitability	7.738	14.568	-84.6	84	-1.682	19.888	7.533	9.709	-20.07	78	1.85	15.791
Liquidity	1.598	2.184	0.297	27.279	8.617	94.536	1.583	1.325	0.228	10.28	3.473	19.003
2010							**2011**					
Variables	**Mean**	**Std dev.**	**Min**	**Max**	**Skewness**	**Kurtosis**	**Mean**	**Std dev.**	**Min**	**Max**	**Skewness**	**Kurtosis**
Disclosure	0.352	0.229	0.016	0.883	0.604	2.238	0.385	0.226	0	0.8833	0.399	2.09
Qualitative Dis	0.423	0.2368	0.000	0.971	0.591	2.327	0.453	0.2396	0.000	1.000	0.422	2.174
Quantitative Dis	0.2597	0.2364	0.000	1.000	0.604	2.361	0.2959	0.2293	0.000	0.769	0.346	2.027
Board Size	9.116	2.443	4	17	0.833	3.424	9.101	2.432	5	17	0.936	3.455
Non-Exec.	0.651	0.11	0.375	0.909	-0.186	2.549	0.669	0.103	0.375	0.916	-0.303	2.756
Environ. Commit.	0.078	0.269	0	1	3.129	10.791	0.074	0.262	0	1	3.252	11.58
Audit Committee	3.613	0.929	2	7	1.186	4.683	3.641	0.91	2	8	1.548	6.41
Director Own.	5.195	12.936	0	64.434	2.991	11.3	5.054	12.724	0	64.429	3.043	11.67
Ownership Conc.	39.978	17.385	3.78	85.03	0.159	2.416	41.181	17.909	3.55	84.21	0.075	2.267
Size	9947.5	33083.2	50.7	322560	6.955	58.275	10718.26	35289.84	51.5	345257	6.967	58.858

Gearing	1.412	10.655	0.033	155.375	14.111	203.77		1.532	12.021	0.033	173.997	13.865	198.213
Profitability	9.927	10.025	-11.41	103	4.134	36.568		10.695	11.09	-16.13	120.388	4.79	46.676
Liquidity	1.615	1.271	0.185	10.099	2.88	14.642		1.669	1.863	0.215	21.612	6.775	65.909

The firm size (measured by total assets) had a wider range and great variability between years. For example, total assets ranged from £40 million to £345,257 million, with a mean of £9,594 million and standard deviation of £31,638 million. The majority of the firms sampled were highly geared (mean of 1.52). There was great variability with regard to profitability. For example, companies in the sample had a return on assets ranging from −84.6 per cent to 120.4 per cent, with a standard deviation of 11.5724. It is also noticeable that the company size, gearing, liquidity and profitability variables have high levels of kurtosis. However, Tabachnick and Fidell (2007) argued that in large samples, the impact of skewness and kurtosis values from normality is suppressed. In this case, therefore, the effect of the non-normal distribution in the independent variables is unlikely to affect the final outcome. Nonetheless the regression model involving all these non-normal variables will be subjected to robustness option in Stata 12. Only 7 per cent of the sampled firms had environmental committee and for over 4 years this number has hardly changed.

8.1.2 Correlations

Table 12 below two shows the correlation between all variables used in the study.

Table 12: Correlation among dependent and independent variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Disclosure - All	**1.000**													
2	Qualitative Dis	0.974***	**1.000**												
3	Quantitativ. Dis	0.953***	0.859***	**1.000**											
4	Board Size	0.386***	0.381***	0.360***	**1.000**										
5	Non-Executive.	-0.28***	0.159***	0.156***	0.109***	**1.000**									
6	Environ. Comm	0.127***	0.124***	0.122***	0.080**	0.155***	**1.000**								
7	Audit Comm.	0.259***	0.248***	0.254***	0.477***	0.239***	0.041	**1.000**							
8	Ownership Con	-0.28***	-0.28***	-0.26***	-0.24***	0.018	-0.074**	-0.25***	**1.000**						
9	Director Own.	-0.21***	-0.20***	-0.22***	-0.11***	-0.11***	0.021	-0.14***	0.213***	**1.000**					
10	Size	0.274***	0.275***	0.250***	0.457***	0.199***	0.057*	0.202***	-0.15***	-0.09***	**1.000**				
11	Profitability	-0.016	-0.013	-0.019	-0.041	0.073**	0.045	0.007	0.041	0.033	0.036	**1.000**			
12	Leverage	-0.034	-0.037	0.028	-0.039	-0.018	-0.022	-0.042	-0.064*	-0.029	-0.015	-0.025	**1.000**		
13	Liquidity	-0.11***	-0.11***	-0.11***	-0.14***	0.054	0.01	-0.10***	0.177***	0.112***	-0.071**	-0.021	-0.015	**1.000**	
14	Industry	-0.042	-0.043	-0.043	0.063*	0.05	0.092***	0.03	0.033	0.049	0.170***	0.025	0.092***	0.218***	**1.000**

As expected, GHG disclosure is positively related with size, board size, environmental committee, and audit committee. Non-executive directors, director ownership, ownership concentration, gearing, liquidity, profitability and industry are negatively correlated with GHG disclosures but it is only profitability, gearing and industry whose relationship is not significant. A similar pattern is repeated for both qualitative and quantitative disclosures. There were also some significant correlations between independent variables with the highest being that of board size and audit committee size at 0.47. However this is considered no threat as it falls below the maximum threshold of 0.8 or 0.9 as recommended by Field (2009). Although the correlation matrix does not depict a highly significant correlation between the independent variables, the variance inflation factors was also analysed. According to Field (2009), low values of VIF are expected if the multi-collinearity problem is to be controlled. Our mean VIF was 2.57 and the highest VIF was 2.58 for company size. This means then that multi-collinearity is not prevalent in the model. To control for hetero-scedasticity in the standard errors the option of robust in Stata 12 (Greene, 2008) was used. Thus apart from just addressing hetero-scedasticity issues, the robust option deals with other minor concerns bordering on failure to meet other assumptions like normality or excessively large residuals, or influence from a particular variable. Therefore without altering the point estimates of the coefficient as derived from OLS, with the robust option, standard errors adjust for any concerns of data abnormality or hetero-scedasticity.

8.2 REGRESSION RESULTS

Table 13 presents the results of the Ordinary Least Squares (OLS) panel regression with robust standard errors of the governance and firm characteristics on GHG voluntary disclosures.

Table 13: Model 1 - Disclosure and all variables

GHG Disclosure (DV)	*Coefficient*	*Robust Std. Err.*
Board Size	0.0062	0.0040
Non-executive Directors	-0.0179	0.0701
Environmental Committee	0.0565*	0.0303
Audit Committee	-0.0684	0.0814
Ownership Concentration	-0.0011***	0.0004
Director Ownership	-0.0016***	0.0005
Size	0.0666***	0.0063
Profitability	0.0006	0.0005
Gearing	-0.0010***	0.0002
Liquidity	0.0061	0.0053
Industrials	0.1327***	0.0288
Consumer Services	0.1126***	0.0317
Oil & Gas	0.0551	0.0353
Basic Materials	0.0722**	0.0343
Consumer Goods	0.0434	0.0306
Telecommunications	0.0527	0.0556
Utilities	0.0668	0.0491
Technology	0.0219	0.0293
Year 2009	0.0562***	0.0177
Year 2010	0.0912***	0.0183
Year 2011	0.1184***	0.0185
R-Squared	*0.37*	
Adj. R-Squared	*0.35*	

****p ≤ 0.01, **p ≤ 0.05, and *p ≤ 0.10.*

Results indicate a significant positive relationship between GHG voluntary disclosure and each of company size (p≤ 0.001), Industrials (p≤ 0.001), Consumer services (p≤ 0.001), basic materials (p≤ 0.001) and Environmental committee (p≤ 0.10). A significant negative association was obtained between GHG voluntary disclosure and each of ownership concentration (p≤ 0.001), director ownership (p≤ 0.001), and gearing (p≤ 0.001). However, there was no significant relationship between GHG voluntary disclosure and each of board size, non-executive directors, audit committee, profitability, liquidity and other industry categories namely oil & gas, consumer goods & services, telecommunications, utilities and technology. Only audit committee had a negative non-significant relationship with GHG voluntary disclosure while the others were non-significant but positive. The model has an

adjusted *R* Squared of 35.8% implying that almost 35% change in GHG voluntary disclosures is explained by the modelled determinants.

Beyond assessing the suitability of the financial variables to overall GHG disclosure the study extends investigation to see if the suitability of these variables differs depending on the nature of GHG information disclosed. In this case the dependent variable is decomposed into qualitative and quantitative disclosures. In environment and climate change disclosures in particular, prior literature documents evidence of symbolic disclosure or greenwashing or simply legitimation disclosures (Hrasky 2012; Westphal and Zajac 2001; Tilcsik 2010). Under green washing or what Marquis and Toffel (2012) term 'attention deflection' disclosures, firms disclose by highlighting certain desirable activities or their intention to do something as a way of avoiding scrutiny in their actual practices. Thus under greenwashing, organisational disclosures are awash with positive environmental attributes or initiatives while negative ones are concealed.

While the debate on extent of environmental disclosure is now gradually moving towards disclosure quality (Brammmer and Pavelin, 2008; Clarkson et al 2008; Clarkson et al 2011; Aburaya, 2012), there is still no generally agreed benchmark as to what constitute quality. Despite this however there is growing consensus that though quality is a subjective notion, disclosures that include a diverse range of items and are quantified signifies quality and a step further on the part of the disclosing firm to inform its target audience (Siddique et al 2011; Liu et al 2011; Van der Laan Smith et al 2005; Patten 1995; Beattie et al 2004). In fact Van der Laan Smith et al (2004) argued that quantitative disclosures provide more useful information to users while Al-Tuwaijri et al (2004) attributed a higher score to quantitative items in their environmental disclosure quality.

In this study while not focussing on GHG disclosure quality, cognisance is made of the fact that some disclosures might be made for greenwashing purposes hence the decomposition of the disclosure index into qualitative and quantitative disclosures. This is not fully explored in the growing literature on GHG voluntary disclosure. Aggregated measures have the tendency to shift attention or mask exactly what is being disclosed hence it is possible that firm characteristics might influence different disclosures differently. Previous evidence suggests that analysis of disclosures in different categories provide a comprehensive and richer insights into disclosure quantity (Beattie et al 2004) and that this help to profile different disclosure strategies employed by firms (Beretta and Bozzolan, 2004).

When disclosure quantity is categorised into qualitative and quantitative groups, there

is a slight change in the way the explanatory variables relate with the dependent variable. Under qualitative disclosures, the relationship between GHG voluntary disclosure and environmental committee is positive and significant at ($p \leq 0.05$) and all other explanatory factors that were significant with overall disclosure are significant in the same direction. The same remain true of non-significant relationships with the exception of non-executive directors and telecommunications which take a negative direction as opposed to positive in the overall disclosure.

Table 14: Model 1 - Qualitative and Quantitative Disclosure and all variables

	Qualitative Disclosure		Quantitative Disclosure	
Variables	*Coefficient*	*Robust Std. Err.*	*Coefficient*	*Robust Std. Err.*
Board Size	0.0049	0.0041	0.0079*	0.0042
Non-executive Directors	-0.0273	0.0730	-0.0057	0.0748
Environmental Committee	0.0640**	0.0284	0.0467	0.0347
Audit Committee	-0.0940	0.0850	-0.0351	0.0840
Ownership Concentration	-0.0011**	0.0004	-0.001***	0.0005
Director Ownership	-0.0013***	0.0005	-0.002***	0.0005
Size	0.0730***	0.0066	0.0584***	0.0069
Profitability	0.0007	0.0005	0.0004	0.0005
Gearing	-0.0012***	0.0002	-0.001***	0.0003
Liquidity	0.0067	0.0005	0.0053	0.0054
Industrials	0.1384***	0.0283	0.1252***	0.0325
Consumer Services	0.1087***	0.0311	0.1178***	0.0325
Oil & Gas	0.0588	0.0370	0.0502	0.0363
Basic Materials	0.0528	0.0339	0.0977**	0.0378
Consumer Goods	0.0261	0.0303	0.0659*	0.0352
Telecommunications	-0.0331	0.0414	0.1649**	0.0857
Utilities	0.0696	0.0491	0.0631	0.0514
Technology	0.0239	0.0299	0.0195	0.0327
Year 2009	0.0636***	0.0187	0.0465**	0.0186
Year 2010	0.0988***	0.0189	0.0813***	0.0196
Year 2011	0.1242***	0.0193	0.1108***	0.0198
R-Squared	*0.38*		*0.32*	
Adj. R-Squared	*0.36*		*0.30*	

****p ≤ 0.01, **p ≤ 0.05, and *p ≤ 0.10.*

Under quantitative disclosures, in addition to all explanatory variables significant with overall disclosure, voluntary GHG disclosure is positive and significant with each of board size ($p \leq$

0.10), telecommunications (p≤ 0.05), and consumer goods and services (p≤ 0.10). Non-executive directors' proportion also has a negative non-significant relationship with voluntary GHG quantitative disclosures. Both the qualitative and quantitative models have explanatory powers of 36% and 30% respectively.

In addition, based on survey of prior literature it is noted that industry variable is categorised differently (e.g. Prado-Lorenzo et al., 2009 had 11 categories; Rankin et al., 2011 had 4 industries; Freedman and Jaggi, 2005 had 5). Therefore, the industry variable was classified based on the Industry Classification Benchmark (ICB) and this resulted in 9 industries after excluding financial industry. However, to overcome some multicollinearity problems the industry variable is transformed into one dummy variable and then the regression is run again. Cho et al (2012) noted that variations in industry classification might affect the outcome hence called for a careful scrutiny as to how industry variables are included in models. The results are summarised in Table 15 below.

Table 15: Model 2 - Disclosure with one Industry Variable

GHG Disclosure (DV)	*Coefficient*	*Robust Std. Err.*
Board Size	0.0045	0.0039
Non-executive Directors	-0.0618	0.0695
Environmental Committee	0.0474	0.0299
Audit Committee	-0.1014	0.0795
Ownership Concentration	-0.0010**	0.0004
Director Ownership	-0.0016***	0.0005
Size	0.0681***	0.0061
Profitability	0.0007	0.0005
Gearing	-0.0007***	0.0002
Liquidity	0.0024	0.0055
Industry	-0.0452***	0.0134
Year 2009	0.0567***	0.0177
Year 2010	0.0920***	0.0184
Year 2011	0.1199***	0.0186
R-Squared	*0.35*	
Adj. R-Squared	*0.34*	

****p ≤ 0.01, **p ≤ 0.05, and *p ≤ 0.10.*

When the industry variable is transformed into one dummy variable and the main regression model is run again, there is a minor change to the results. The industry dummy becomes negative but significant at ($p \leq 0.001$). Overall this model explains 34% change in voluntary GHG disclosures.

8.3 Discussion of Results

Based on table 15 which has the main model, the R^2 adjusted is 34 per cent and the model is highly significant (F=21.95, p=0.000). The explanatory power of the model is consistent with some prior studies (Prado-Lorenzo et al. (2009) had 38.3 per cent; and Freedman and Jaggi (2005) had 32.0 per cent. The results which indicate that four corporate governance mechanisms, board size, proportion of non-executive directors', audit committee and environmental committee are not significantly associated with GHG disclosure means that hypotheses H1, H2, H3 and H4 are rejected. However, the results also indicate that the other two corporate governance mechanisms (ownership concentration and director ownership) have a significant negative relationship with GHG information disclosure. This suggests that hypotheses H5 and H6 in respect of ownership concentration and directors' share ownership are confirmed respectively. Of the firm characteristics, only size and gearing are significant (β=.07, p.001; β=.0001, p.001) while profitability and liquidity are not. Thus hypotheses H7 and H8 are confirmed while hypotheses 9 and 10 are rejected with respect to the firm characteristics.

The significant negative relationship between both ownership concentration and directors' share ownership and GHG disclosure means that those firms whose ownership is concentrated in the hands of a few and directors owning fewer shares disclose more GHG information. The result on ownership concentration is both consistent with other prior evidence (Matolcsy et al., 2012; Brammer and Pavelin 2008) and contradictory to others (Berthelot and Robert, 2012; Haniffa and Cooke, 2002). Suffice to say that of these studies, it is only Berthelot and Robert (2012) that exclusively focused on climate change disclosures while the others focused on environmental disclosures in general. Similarly, no prior evidence is found testing the relationship between managerial ownership and GHG disclosures. With regard to ownership concentration, in addition to managers satisfying these shareholders through other means which may lead to fewer disclosures, this result may imply a power conflict between shareholder demands and managerial discretion on matters of strategic importance. From strategic management literature (David et al., 2007; Ashforth and

Gibbs, 1990; Brehm and Brehm, 1981), it is understood that managers are not always receptive to external challenge on their authority over matters of corporate policy; when faced with such a circumstance as shareholder influence on climate change and GHG emissions disclosure policy, they may engage in any mechanism to defend their *status quo*. David et al. (2007) argued that in reaction to such increased pressure managers may simply react by diverting resources from such activities and use them to resist external pressure and towards retaining their discretion.

The non-significant results in respect of board size and non-executive directors contradicts the prediction by agency theory which posit these as pillars of transparency and accountability that may lead to more voluntary disclosure. For example, the Combined Code (2012) encourages boards to have more non-executive directors as a way of enhancing board independence and improving its monitoring efficiency in a bid to reduce managerial opportunism, yet the results suggest no such influence. The board size results also contradict prior evidence (Peters and Romi, 2012; Cormier, Ledoux, Magnan and Aerts, 2011) but is consistent with other studies like Michelin and Parbonetti (2012) whose focus was on sustainability disclosure. Based on the descriptive statistics, the study sample, just like prior studies, exhibited presence of large sized boards which in themselves might be a source of conflict and monitoring problems. Prior literature suggests that lack of coordination in boards slows down decision making and hence decreases board performance efficiency (Yermack, 1996; Jensen, 1993).

The result on board size could also be interpreted in line with existing debate regarding the existence of a U-shaped board-environmental relationship where an optimal board exists mid-way (Cormier et al 2011). Thus with a U-shaped relationship it is argued that below the optimal size there is a positive relationship between board size and information asymmetry and thereafter a negative relationship follows. The descriptive statistics suggest that companies on FTSE350 have, on average, large sized board as such this may make the board less effective as it is often plagued with monitoring and coordination problems (Yermack, 1996). The result may also been seen in light of the institutional theory in that over time with both mimetic and coercive pressure companies have instituted their boards in similar manner/pattern as such GHG disclosure cannot be differentiated based on board size. This then entails the need to go beyond board size and review the particular characteristics of members of the board responsible for environmental and GHG reporting. Prado-Lorenzo and Garcia-Sanchez (2010) also concluded that boards as a whole are not proactive when it comes

GHG information disclosure rather they do intervene whenever they deem that non-intervention or lack of being seen to be on top of the related environmental matter may adversely affect the firm. In this respect authors like Money and Schepers (2007) have long called for the restructuring of the board as it currently stands so as to ensure a balance between pro-shareholder interests' structures and pro-other stakeholder interests' structures.

Similarly, there is no known GHG voluntary disclosure study that investigated NED but the non-significance of NED in the model suggests that proportion of NEDs on board do not have any influence of GHG disclosures. As NEDs often represents the level of independence relating to board decision, it suggests that whether the board is free from material influence by either owners or managers is of no consequence to GHG disclosures. Seen in the light of agency theory, this is a contradiction because agency theory encourages high numbers of NEDs on the board as a mechanism to keep in check managerial opportunism and reduce agency costs. However the result is consistent with other prior studies (Ho and Wong, 2001; Brammer and Pavelin (2006) but also contradicts others (Post et al., 2011 who found positive significant relationship with environmental disclosures). The result could be due to a number of reasons. Mangena and Tauringana (2007) argue that NEDs might be preoccupied with other matters and hence may not give necessary attention to equally important matters of disclosures or may simply delegate it to a particular sub-committee. Others argue that, in practice, NEDs may not be independent per se due to other influences that may compromise their professional judgements (Buniamin et al., 2008). De Villiers et al (2011) also argued that while board independence as symbolised by presence of NED is important in influencing environmental performance, extremely high levels of independence in a board may result in lack of specific firm knowledge necessary in environmental related issues. In their findings they had a non-linear relationship between board independence and environmental performance.

Another plausible explanation could be that these board structures are yet to reposition themselves to meet the challenges of climate change. In the sample only 7 per cent of the firms had indicated having a special social and environmental committee. Kock et al. (2012) alluded to the fact that board characteristics as those covered in the study were primarily designed for different set of objectives as such may not be useful in achieving environmental objectives. Mallin et al. (2013) argue that there is no straightforward path between corporate governance to social and environmental disclosures hence called for innovative techniques of proving the link. Arguably the period covered by the study

coincided with the financial crisis hence firms and their boards were preoccupied with repositioning themselves to respond to the inadequacies exposed during the crisis hence issues relating to GHGs might have had less prominence.

The presence of corporate environmental committee had no meaningful significance on voluntary GHG disclosures. This contradicts our theoretical framework which argued for more disclosures by companies with such a committee and other prior studies (Peters and Romi, 2011; Hassan, 2010). One reason could be that though social and environmental committees are being entrenched within FTSE350 companies, they are yet to find their feet in as far as GHG emission reporting is concerned. This could be supported by the fact that when regressed against qualitative disclosures it turns significant but non-significance is maintained with quantitative disclosures. Rankin et al. (2011) who also found the presence of environmental committee to be non-significant argued that firms might just be creating these portfolios just to gain legitimacy but in reality real power and authority to achieve genuine GHG emissions reductions has not been given to them. The other reason for the weak significance in EC could be that in practice committees do not make final decisions on matters of their jurisdictions rather they do recommend and is up to the board to adopt it or not. In their mixed method approach which included interviews, Rodrigue et al (2013) reported that informants had stated that in practice decisions to implements environmental projects are taken by the board as a whole and not at committee hence this might explain how the final outlook on environmental initiatives may not be fully influenced by the presence of the environmental committee alone. Overall they concluded that environmental committees are primarily set up to ensure that environmental regulatory issues are complied with but 'are not intended to proactively improve environmental performance'. Seen in the light of legitimacy theory this implies that environmental committees may be set up for legitimation purposes rather than real intention of being green (Peters and Romi 2012; Hrasky 2012). This is also consistent with the findings of Liao et al. (2014) who found that environmental committees of FTSE 350 companies did not have significant effect on the extent of carbon disclosures. In this respect they argued that though board environmental committee may decide on disclosure policy yet the decision as to what actually is disclosed could be taken at a lower technical level.

Though audit committees are credited with enhancing the board monitoring efficiency, the model results did not find any significance. One possible explanation could be that there is little if none auditing relating to environmental information hence the role of the

audit committee may not be deemed necessary unless such information has direct effect on balance sheet figures which seems not the case at the moment. The descriptive statistics show that only 27 per cent of sampled firms had indicated the use of assurance services with regard to GHG emission information in 2011 underscoring the fact that significant role of auditing on GHG emission information is yet to emerge.

The positive and significant relationship between size and GHG disclosures are consistent with prior literature (Freedman and Jaggi, 2005; Prado-Lorenzo *et al.,* 2009; Rankin et al., 2011; Berthelot and Robert 2012; Brammer and Pavelin, 2006; Gray *et al,* 2001; Cormier and Magnan, 2007). As noted being large means being very visible and subject to intense public scrutiny which then might force a firm to make more disclosures as way of deflating criticism. But being large is also synonymous with being resource rich which may enable managers exercise more flexibility in their disclosure decisions unlike in small firms where resources are deemed in short supply (Bowen, 1999; Liu and Anbumozhi, 2009; Rupley *et al.,* 2012; Reverte, 2008). A large firm is also expected to have a large network of stakeholders hence might engage in disclosures to manage their expectations. This result is also consistent with the findings of the review done by Guidry and Patten (2012) who found that six of the ten studies they reviewed had found size to be positive and significant. The authors however noted that in most of these studies (Brammer and Pavelin, 2006; Clarkson *et al.,* 2008; Cormier and Magnan, 1999; Ho and Taylor, 2007; Magness, 2006; and Bewley and Li, 2000), size was often a control for political cost exposure rather than information asymmetry based proxy.

The negative but significant coefficient in respect of gearing means that highly geared companies are likely to disclose less information on GHG emissions. While the result contradicts findings of prior studies on GHG disclosures (see Freedman and Jaggi, 2005; Prado-Lorenzo et al., 2009; Rankin et al., 2011), it is consistent with the findings of Brammer and Pavelin (2008). This result could be seen in light of signalling theory in that low geared firms could be motivated to disclose more GHG information to signal to market with the hope of tapping into the euphoria of attracting cheap capital through investors interested in socially and environmentally responsible firms.

The coefficients for profitability and liquidity are statistically insignificant meaning that the level of profitability and liquidity do not influence the level of voluntary GHG disclosures. This result, particularly profitability, is in line with prior studies (Wegener *et al.,* 2013; Freedman and Jaggi 2005; Rankin *et al.,* 2011; Stanny and Ely, 2008) but contradicts

agency theory and stakeholder theory propositions. Thus according to Oliviera et al. (2006), profitability just like size makes a company to be politically visible and hence a target of many stakeholder pressure for transparency. In addition, contrary to the findings of Liu and Anbomuzhi (2009) who documented non-significance of profitability with overall environmental disclosures but significant with some specific environmental information, the current study did not find any significance in both qualitative and quantitative models. Liquidity, though not yet tested in GHG voluntary disclosure studies, is also comparable to other prior studies. Others found negative association (Ho and Taylor, 2007; Gul and Leung 2004) while Barako *et al.* (2006) found no significance. The finding on liquidity contradicts the set hypothesis but it is difficult to put in the right perspective since most secondary data based environmental and almost all GHG voluntary disclosure studies have often excluded it from their models hence making comparison hard.

The finding on the industry variable is interesting but ambiguous when compared to prior studies. Prior literature on climate change and GHG emissions disclosures (Prado-Lorenzo et al., 2009; Freedman and Jaggi, 2005; Rankin et al., 2011) though not in complete agreement of which sectors are more prominent when it comes to disclosure largely agree that some industries deemed heavy polluters are the ones that disclose more information. The results contradict this and instead find evidence that those industries deemed as less environmentally risky disclose more information than their counterpart. When the industry dummy is decomposed into nine categories, a similar pattern is observed with most of those deemed heavy polluters in the name of oil & gas, utilities and consumer goods having a non-significant relationship with GHG voluntary disclosure. Apart from sample characteristics and instrument of measuring extent of disclosure, the result may also reflect the nature of GHGs itself. Those firms in heavy polluting industries may feel that more disclosures may expose them more hence may not be forthcoming when it comes to transparency and accountability of their emissions (Wegener et al., 2013). On the other hand, less environmentally risky industries may disclose more as a way pre-empting and any potential regulation that might be costly to comply with. In addition as highlighted by Lewis et al. (2013) lack of disclosures in these heavy polluting industries could be a reflection of the uncertainty surrounding stakeholder reactions on firms after its disclosure.

Besides industry effects, the results have also clearly demonstrated the effect of time in the disclosure trend. The importance of time effects in 2010 and 2011 can be seen through the *t*-ratio which is higher in those years than in 2009. In particular the difference between

2009 and 2010 is higher compared to the difference between 2010 and 2011. Arguably this could be as a result of a number policy initiative that motivated or encouraged firms to measure and report GHG emissions notably the introduction of DEFRA (2009) guidelines. DEFRA guidelines came into effect in 2010 hence the difference could be attributed to the same. Thus the increase in the extent of reporting could be the direct consequence of the DEFRA guidelines which were introduced in 2009 and were available for use for reports in 2010. The positive outcome here is consistent with prior studies for instance Freedman and Jaggi (2005) whose investigation found that firms operating in Kyoto ratifying countries had more disclosures than their counterparts not in Kyoto ratifying countries. Similarly, Sidaway and De Lange (2011) found that the introduction of National Greenhouse and Energy Reporting (NGER) in Australia had positively influenced firms not targeted by the Act to voluntarily disclose climate change information. Besides, in other prior research evidence, there is an indication that companies tend to respond positively to government guidance or proposal in anticipation of regulation. For example, Llena et al. (2007) state that every time there was significant milestone achieved related to environment and GHGs such as the Kyoto Protocol or the issuance of European Commission (EC) recommendation on measuring and reporting environmental information in annual reports, general interest relating to accounting and reporting of such information increased among European Union based firms. Inchausti (1997) found that in Spain, legislation, even before it became compulsory, had a strong bearing on the voluntary accounting disclosures made by companies. Rankin et al. (2011) attributed the increase in GHG disclosures by Australian firms over time as a possible response to public and policy pressure.

From the evidence it could be argued that firms appeared to have embraced the DEFRA (2009) guidelines as pseudo-regulatory guidelines that were pointing out to future policy direction hence they considered compliance with the same as yardstick to complying with future legislation. It could also suggest that the DEFRA (2009) provided a reasonable justification for management to invest in systems that could collect and report GHGs. In fact the Confederation of British Industry (CBI), an influential industry umbrella body in the UK, hailed the introduction of DEFRA (2009) as the right step that will lead to mandatory reporting which they had been calling for as a way of achieving consistency and comparability of results (CBI, 2011). Thus although there is available evidence of institutional investor activeness in certain voluntary GHG reporting a scheme like CDP, there is little or no evidence that investors pressurise managers to disclosure this information in

other forma avenues like annual reports or sustainability reports. Gouldson (2012) argued that the reason the quality of GHG disclosures was low in UK major supermarkets reports was due to lack of genuine interest in such information by major shareholders. This then means management could not reasonably justify any significant investment in GHG systems that could ensure disclosures in the absence of pressure from investors hence relying on the DEFRA guidelines to justify the same. In fact Griffiths et al. (2007) argued that in the absence of a government regulation or persuasion, GHG disclosures remain the discretion of management. Therefore in light of institutional theory, the introduction of DEFRA (2009) and other government initiatives on climate change are seen as coercive forces meant to pressure firms into following a preferred system of reporting.

8.4 Primary Data Analysis

8.4.1 Respondents' background

The results of Section A of the questionnaire (see Appendix I) indicated that out of the 62 respondents, seventeen or 27 per cent identified themselves as having a senior position in finance and accounting, nine or 14.5 per cent stated that they were company secretaries and/or investor relations directors while the majority, 36 or 58 per cent indicated they were senior managers or heads of sustainability and environment. The fact that the majority were senior managers dealing with environmental issues is not a cause for concern as such individuals are considered appropriate replacements of finance directors when it comes to disclosures of environmental information (Wilmhurst and Frost, 2000). For example, Cormier et al. (2004) suggested that environmental managers should be the focus of attention with respect to environmental disclosures since they are managers who implement the broad disclosure policies established by the board and communicated by the CEO. Regarding gender, only seventeen per cent of respondents were female, an indication of male dominance in senior management positions within the sample.

The majority of the respondents (33 i.e. 53 per cent) indicated they were below fifty years of age while 47 per cent were fifty or older. Twenty three (23) of the respondents or 37 per cent indicated that they had been in their positions for a period of over ten years while 63 per cent had been in their positions for a period of between four and nine years. Solomon and Lewis (2002) noted that length of service was important because the longer someone stays in a position the more knowledgeable they are. In levels of education, 48.3 per cent stated that

they had qualifications above a college degree, while the rest indicated that they were in possession of a college degree.

8.4.2 Questionnaire results

Respondents were asked to consider a list of ten variables (six corporate governance mechanisms and four firm specific variables) and then to indicate on a five point Likert scale (1-strongly disagree to 5-strongly agree) the extent to which each of the variables influence GHGs voluntary disclosure in their firms (see Appendix I, Section B). Results are presented in table 16 below. The results of a two way sample *t*-test for the four corporate governance mechanisms (board size, proportion of non-executive directors, ownership concentration and directors' share ownership) that were also investigated using the quantitative approach indicated that the mean scores except for ownership concentration were statistically different from the neutral point (3=neutral) and significant at a one per cent level. Since the mean values of the three corporate governance mechanisms are all below the neutral point, this suggests that the respondents do agree that GHG voluntary disclosures are influenced or not influenced by three corporate governance mechanisms. Similarly, the lack of significant difference in respect of ownership concentration means that there is no evidence to suggest that the respondents perceive ownership concentration as influencing or not GHG voluntary disclosures.

Table 16: Determinants of GHGs – Survey Responses

Determinants of GHG disclosures	Mean Score	Standard Deviation	% agreed or strongly agreed	% disagree or strongly disagree	% neutral
Board committee Size	2.10***	0.86	2.8%	63.9%	33.3%
Audit committee size	1.97***	0.94	2.8%	63.9%	32.4%
Proportion of non-executive directors on the board	2.35***	0.86	5.6%	55.6%	38.9%
Board Committee on environment	3.40**	1.23	62.2%	21.6%	16.2%
CEO Duality	2.33***	1.00	13.9%	54.1%	29.7%
Ownership concentration	2.73	1.13	36.1%	44.4%	19.4%
Director share ownership	2.50***	0.93	11.1%	50.0%	38.9%
Size of company	3.51***	0.93	55.6%	13.9%	30.6%
Company gearing	2.46***	0.92	8.3%	50.0%	41.7%
Company profitability	2.83*	1.06	22.2%	44.4%	33.3%
Company liquidity	2.48***	0.94	8.3%	50.0%	41.7%

**** p<0.001, ** p<0.01, * p<0.05 significantly different from a mid-neutral point of 3*

Of the remaining corporate governance mechanisms (CEO duality, audit committee and sub-board committee on environment) included in the questionnaire but not in the regression analysis below, the results suggest that their *t*-values are statistically significant from the mean. However, the mean value of 3.40 in respect of the sub-board committee on the environment which is above the neutral point of 3.0 means that this mechanism is perceived as having a significant influence on GHG voluntary disclosure. The mean value for CEO duality of 2.33 which is below the neutral point suggests that this mechanism does not significantly influence the extent of GHG voluntary disclosures.

The results of a two way sample *t*-test for the four firm variables show that the mean values are all different from the neutral point and statistically significant. However, the fact that the mean value for firm size is higher than the neutral point means that this variable is perceived as having a significant influence by our respondents. In fact about 55 per cent of survey respondents said either agreed or strongly agreed that size plays a vital part on their GHG disclosure decisions. Since the mean values of the three financial variables are all

below the neutral point, this suggests that the respondent do not agree that GHG voluntary disclosures are influenced by three company specific financial variables.

8.5 Regression Results of the Respondent Companies

In order to compare like with like, a sample of the respondent companies (62) were selected and OLS regression for the year 2011 was carried with a view of triangulating with the survey responses. Table 17 shows the results of our regression model including all the governance and control variables.

Table 17: OLS regression of respondent firms for year 2011

Variable	**Model**	
GHG disclosure (DV)	*Coefficient*	*Std. Error*
Board size	-0.026	0.129
Non-Executive Directors	-0.051	0.344
Ownership Concentration	-0.024**	0.006
Director Ownership	-0.012**	0.004
Size	0.079***	0.211
Profitability	0.003	0.004
Gearing	0.173	0.099
Liquidity	0.028**	0.007
R-squared	0.395	
Adjusted *R*-squared	0.292	

**** p<0.001, ** p<0.01, * p<0.05*

The R^2 adjusted is 29.2 per cent and the model is highly significant (F=3.84, p=0.000). The explanatory power of the model is consistent with some prior studies (Prado-Lorenzo et al. (2009) had 38.3 per cent; and Freedman and Jaggi (2005) had 32.0 per cent. The results indicate that two corporate governance mechanisms, board size and proportion of non-executive directors' are not significantly associated with GHG disclosure. However, the results also indicate that the other two corporate governance mechanisms (ownership concentration and director ownership) have a significant negative relationship with GHG information disclosure (β=-.02, p.01; β=-.01, p.001) respectively. Of the firm characteristics, only size and liquidity are significant (β=.07, p.001; β=.02, p.01) while profitability and

gearing are not.

Nonetheless the sample size of 62 could be somewhat small to accommodate all the 8 variables at the same time as this may result in model over fitting. According to Miller and Kunce (1973); Field (2009), a rule of thumb allows 1 variable per ten observations meaning to avoid over fitting the appropriate number of variables is six. Therefore a further 3 models containing different combination of the variables up to a maximum of six were regressed to assess whether the outcome will be materially different from the original. Table 18 below summarises the results.

Table 18: Alternative Multiple regression models for survey respondents

Variable	**Model 1 (exc. BS & ROA)**		**Model 2 (exc.NED & ROA)**		**Model 3 (exc. BS & NED)**	
GHG disclosure (DV)	*Coefficient*	*Std. Error*	*Coefficient*	*Std. Error*	*Coefficient*	*Std. Error*
Board size			-0.0001	0.016		
Non-Executive Directors	-0.005	0.284				
Ownership Concentration	-0.024**	0.009	-0.024**	0.009	-0.024**	0.009
Director Ownership	-0.012***	0.005	-0.012**	0.006	-0.012**	0.005
Size	0.072***	0.179	0.072***	0.024	0.075***	0.018
Profitability					0.003	0.004
Leverage	0.133	0.119	0.133	0.118	0.172	0.126
Liquidity	0.023**	0.01	0.023**	0.01	0.028**	0.012
R-squared	0.386		0.386		0.395	
Adjusted R-squared	0.311		0.31		0.321	

**** p<0.01, ** p<0.05, * p<0.10*

As per table 18 above there were no material differences regarding the explanatory power of the original model and the other models. In particular there was no change in direction and significance of variables in all the three models. This then means that the original model is not affected by the problem of over fitting. Moreover Knofczynski and Daniel Mundfrom (2008) states that minimum thresholds like those of sample size to predictor ratios are there for a guide only and that prior literature and the objectives of the

research should be considered first before applying the minimum guidelines.

Furthermore, as part of robustness test the study also reviewed the possibility of including CEO duality, audit committee and board environmental committee in the model since these were specifically included in the survey questionnaire. However based on the sample these were deemed inadequate to generate meaningful statistical results. For instance there were only three firms with CEO duality while only 9 firms had a board social and environmental committee.

8.6 Discussion: Survey Results vs. Regression Results

Taken overall, the results from the two research methods are consistent in that they both suggest that corporate governance characteristics (board size and proportion of non-executive directors) do not determine the extent of GHG disclosures. The lack of support for the relationship between these governance variables and GHG disclosure, while surprising, is in line with a growing body of literature that suggest the inadequacy of existing board structures in championing sustainability reporting (Michelon and Parbonetti, 2012; Walls et al., 2013). Wang and Hussainney (2013) argued that it is still debatable as to whether certain governance characteristics as advocated by UK corporate governance guidance are effective in improving narrative reporting in general. Mallin et al. (2013) suggested that there is no straightforward relationship between corporate governance and social and environmental disclosures, and hence called for innovative techniques to prove the link.

The results from both the primary data and secondary data quantitative approach may also suggest that traditional board proxies are not effective/good enough to depict the role of the board relating to legitimating activities. This could explain why when put to them, survey respondents unequivocally disagreed with a score of over 50 per cent on each item i.e. board size, NED, and CEO duality, that these do influence disclosure decision, but unanimously agreed with presence of a board sub-committee on environment. Being a new phenomenon (only eight firms in our sample had such a committee), the strong agreement by survey respondents may suggest that firms now realise the need to go beyond existing board structures in order to discharge their environmental information disclosure responsibilities. Kock et al. (2012) alluded to the fact that board characteristics such as board size and NEDs were primarily designed for different set of objectives, and so may not be useful in achieving environmental information disclosure objectives. Moreover researchers have found evidence that despite all the talk about environment and governance, the directors perceive their role as

being primarily centred on the old tradition of protecting shareholders' interests, and hence they set aside any stakeholder pressure for more environmental action as their reputation is not at stake (Rodrigue et al., 2013; Hillman et al., 2001).

On the other hand, the two research approaches yielded different results for the other two corporate governance variables (ownership concentration and directors' share ownership). While a negative and significant influence of both ownership structures through secondary data is found, a strong rejection by the survey respondents on the influence of these is documented. This could be interpreted from two perspectives. The strong disagreement from respondents could arguably imply that due to the current form of corporation in which ownership is diversified from management and to the increased emphasis on the board of directors rather than on shareholders, managers perceive shareholders as being of no significant influence in implementing policy including disclosure.

Alternatively the explanation could lie in how far 'shareholder activism' (Reid and Toffel, 2009) influences managerial decision making. First, it is understood that, on its own, shareholder activism has little chance of success in influencing managerial decisions on social and environmental issues unless it is channelled through other means like advocacy groups (Gillan and Starks, 2007; Reid and Toffel, 2009). This could be true for climate change and GHG emissions disclosures where managers may perceive compliance with requirements set by private groups like the Carbon Disclosure Project (CDP) requirements (an NGO grouping of investors promoting transparency and accountability on GHGs) as being more important than responding to their own shareholder demands. Consistent with the prediction of stakeholder theory, shareholder activism gains salience, power and legitimacy through groupings like CDP or CERES which then forces managers to respond rather than just responding to their own shareholder demands (Cotter and Najar, 2011). According to Mitchell et al. (1997) stakeholder demands are met in accordance with power and legitimacy hierarchy. Second, there is mounting evidence that in most cases formal shareholder pressure on management through resolutions is often rejected by management due to either management refusing to be seen to cede decision-making power or simply dismissing the resolutions as being too far from reality (Hoffman, 1996; Sasser et al., 2006). Therefore since the survey respondents were people of senior standing within the firms, it is argued that their rejection of external influence in the form of ownership could be a manifestation of this desire to demonstrate that they maintain discretion over matters of strategic and operational importance.

With regards to firm characteristics, the results of both approaches are consistent in that they suggest company size is a significant determinant of GHG disclosure while gearing, profitability and liquidity are not. The consensus on the influence of company size demonstrates that more than anything managers understand that size moderates the extent of their discretion in responding to multi-stakeholder demands for GHG information. As argued by Darnall *et al.* (2010) size also determines how other stakeholders view or react to managerial action on issues at hand. However the fact that size could be seen to represent both the perspective of information asymmetry and social political theories suggests that we may not exactly know what it represents (Graham *et al*., 2005). The evidence from both data sources that gearing, profitability and liquidity play no part on GHG disclosures decisions follows a consistent pattern of evidence from prior studies that when taken together puts into question the validity of these company specific financial variables in environmental or GHG disclosure studies. Guidry and Patten (2012) wondered why voluntary disclosure based theory models particularly from financial disclosure literature have been used in environmental disclosure studies without careful consideration. Their study which reviewed a number of environmental disclosure studies failed to find enough evidence supporting that company specific financial variables such as profitability and gearing were relevant in environmental disclosure research.

Though there are no GHG or environmental disclosure studies that specifically engaged practitioners regarding the actual determinants of these disclosures, the results can also be interpreted in light of other studies that have sought practitioners' opinions regarding important stakeholders on environmental disclosure decisions. It is intimated that if practitioners view information asymmetry reduction as a primary reason for disclosure then shareholders or investors would be considered highly in their ranking. In this respect, the results both agree and contradict prior evidence. Thus, with the exception of Wilmshurst and Frost (2000), the majority have found that shareholder/investor concerns rank second when practitioners decides on environmental disclosures. For instance, when put to the executives of multinationals in Singapore, Perry and Sheng (1999) reported that only 21.4 per cent of firms disclosing environmental information agreed that shareholders/investors were important compared to 71.4 per cent on government. Similarly, Cormier *et al.* (2004) through a survey found that the public were the highly ranked group seconded by investors/shareholders. Recently Dobbs and van Staden (2012) reported that in their survey of New Zealand companies, respondents ranked community concerns as of prime importance to their

environmental disclosure decisions than shareholder/investor rights to information. Arguably the consistent practitioner ranking of shareholders/investors as being second to other interest groups when it comes to environmental disclosures render support to the social political theories and suggest that the information asymmetry based theories are of secondary importance. This is consistent with the notion that the salient of shareholder demands relating to GHG emissions information is not as urgent as that of government, NGOs and public (Sprengel and Busch, 2011).

8.7 Chapter Summary

The chapter presented results and analysis of both secondary and primary data in an attempt to answer the research questions relating to the extent and determinants of voluntary GHG disclosures. In particular the regression model presented in chapter was subjected to an empirical test using data by a sample of FTSE350 over a four year period i.e. 2008-2011. Both secondary and primary data were subjected to a series of statistical tests including descriptive statistics, correlation analysis, OLS modelling and in case of the secondary data, panel fixed effects modelling. Robustness of results is checked through running series of regressions that includes and excludes certain variable of interest. Interpretation and discussion of results is then presented in light of theoretical framework and prior literature.

The descriptive statistics in particular the mean indicate that the extent of voluntary disclosure of GHG emission information by FTSE350 companies is still low but has steadily been increasing since 2008. Thus there has been a noticeable increase in the extent of the disclosures in between 2008 and 2011, an indication that of the increased pressure firms are being subjected from a diverse range of stakeholders notably government related initiatives like the issuance of DEFRA in 2009. In fact, a remarkable increase in the disclosures was reported in between 2009 and 2010 compared to between 2010 and 2011. Evidently there is also a tendency towards disclosure of qualitative information as opposed to quantitative information.

Regarding regression, there was lack of significant relationship between the 'traditional' board characteristics namely board size, proportion of non-executive directors, audit committee and the environmental committee and voluntary GHG disclosures. This could imply inadequacies of existing board structures to serve the emerging area of GHG emission disclosures. Alternatively it could mean that other board structures like environmental committee which are meant to champion GHG emission related issues are yet

to gain the necessary competencies in this area. However it should be noted that the presence of Environmental committee becomes positively significant when regressed against quantitative disclosures. Notwithstanding this, the results indicated significant negative relationship between ownership concentrations, director ownership and voluntary GHG disclosure. This means firms with less ownership concentration and low director ownership have potential to disclose more voluntary GHG emission information.

In as far as firm characteristics are concerned, size and gearing were statistically significant while profitability and liquidity were non-significant. While the outcome on size and gearing reflected the theoretical framework and in the case of size, and profitability also prior literature, the non-significant of both profitability and liquidity continue to cast doubt regarding the suitability financial variables in environmental and GHG disclosure studies.
Perhaps more insightful is the fact that when put to the preparers of the information, with the exception of size, none of the determinants as derived from secondary data were deemed influential in the extent of the disclosures. While this may be true in the realm of Environmental and GHG disclosures where secondary data has also failed to confirm most of the traditional determinants (Guidry and Patten 2012), it also underscores the growing concern of many scholars that the voluntary disclosure phenomenon is quite complex in reality making it difficult to get a complete picture through inferences from secondary data only.

When the survey results are triangulated with the OLS regression of the respondents, the outcome is mixed. The results indicated that the two research methods suggest that board size and proportion of non-executive directors are not significant determinants of GHG disclosure. However, the two research methods results differ in that while the quantitative approach indicate that ownership concentration and director ownership are significant negative determinants of GHG disclosure, our survey results suggest that the two corporate governance mechanisms are not significantly related to GHG disclosure. There is, however, contradictory results with regard to ownership structure in that secondary data based regression confirm them as significant while survey respondents did not support them. The contradicting evidence provided by the two research approaches in respect of ownership concentration and directors' share ownership suggests the need for further research in attempt to reconcile the differences.

CHAPTER NINE

Summary, Conclusion and Recommendations

9.0 Introduction

In recent years, climate change issues have received wider attention from all spheres of life. There is a general consensus that human activity is partly responsible for global warming and related effects as such there have been calls for action. While governments are still yet to provide a coordinated effort in fighting climate change, the private sector has been taking a leading role in ensuring accountability of the anthropogenic global warming. This has led to various initiatives which have provided guidance on how firms can measure and report their GHG emissions. In this respect, the UK government has also been championing efforts to reduce the impact of global warming as evidenced by enactment of the Climate change Act 2008 and subsequent issuance of DEFRA (2009) which laid down measurement and reporting guidance on GHG emissions.

Against this background, this study was set out to investigate the extent, determinants and motivation for GHG emission disclosures by FTSE350 companies in the UK. Thus, the first part reviewed evidence of whether companies in the UK are reporting GHG emissions in accordance with available guidance on GHG emission measurement and reporting while the second part focussed on the different factors which could influence the disclosure of GHG information. The third part relating to motivation/determinants for GHG disclosure involved primary data collection from senior managers of these firms. Overall the thesis intends to make a number of contributions to the reporting disclosure literature and GHG emission policy development in the UK. To begin with it provides a detailed account of GHG emission reporting pattern by FTSE 350 over a four year period using diverse disclosure avenues like annual reports, sustainability reports and websites as opposed to many studies in this areas whose focus has been limited to a single year and in many cases using one disclosure media. Secondly it documents evidence of which governance and firm characteristics matter when it comes to GHG emission reporting. This is important because though GHG emission is categorised like environmental reporting, it has its own distinct characteristics that merit its own investigation. More importantly the thesis goes further investigating the question of determinants from a primary data point of view. Triangulation of outcomes from both secondary data and primary data has been instrumental in assessing the efficacy of existing

governance and firm characteristics in explaining the voluntary disclosure phenomenon.

Therefore in this conclusion chapter, a summary of the results and the context in which they fall is presented. The chapter then detail out potential implications/contribution and concludes by highlighting the study's major limitations and suggest avenues for future research.

9.1 Data and Research Methodology

The study has used both primary and secondary data in answering the set research questions namely: (1) what is the extent of GHG emission voluntary disclosures by FTSE350 over four years? (2) What could the determinants of such disclosures be? (3) Do practitioners view the determinants as being influential in their disclosure decisions? Secondary data has been used to answer questions one and two while primary data has helped analyse the third question. In analysing the second question, a research index methodology leading to panel fixed effects was developed and used while for the third question a survey questionnaire was used and subjected to statistical tests. The disclosure index for the secondary data was developed from a multiple GHG reporting frameworks including both the DEFRA (2009) and the GHG protocol. The sample for the secondary data consisted of 215 companies drawn from a possible sample of 257 firms (which is FTSE350 excluding 93 financial firms). The other 42 firms were excluded due data unavailability or not being listed throughout the study period. For the survey questionnaire the final sample was derived by the number of respondents from the 215 companies.

9.2 Findings and Context

The descriptive statistics indicate that overall, FTSE350 companies disclose little information on GHG emission. Over the four year period the mean disclosure score was 32.5 per cent suggesting that more needs to be done to ensure that more GHG information is provided in the annual and sustainability reports of the firms. However there has been noticeable increase in the GHG emissions disclosures over the four year period covered by the study. While not directly investigated, the significant increase in the disclosures between 2010 and 2011 could imply the influence brought by the introduction of DEFRA (2009) which came into effect in the year 2010. Majorly they disclose qualitative information and governance arrangements in place to tackle climate change while detailed quantitative GHG information, risks arising from climate change and future estimates information are rare.

There is also evidence that the level of disclosure is influenced by corporate

governance variables (board size, directors share ownership and ownership concentration) and company specific characteristics (size, leverage and industry). The results are also consistent with prior studies. For instance, Board size (Peters and Romi, 2012; Cormier et al., 2011); Non-executive directors (Brammer and Pavelin, 2008); Ownership concentration (Matolcsy et al., 2012; Brammer and Pavelin, 2008) and Managerial ownership (Gelb, 2000). Evidently there has been lack of significance by traditional governance determinants namely board size, non-executive and audit committee while the significance of environmental committee was very much dependent on the type of disclosure with qualitative disclosures having a significant relationship with environmental committee. Find below a summary of the outcome of the main model tested.

Table 19: Summary of the results of the main model hypothesis

Variable	***Supported***
Governance characteristics	
Board Size -H1: There is a significant relationship between board size and GHG information disclosure	Not supported
Non-executive directors - H2: There is a positive relationship between the proportion of NEDs on the board and GHG information disclosure	Not supported
Audit Committee - H3: Firms with large Audit Committee Size will disclose more GHG emissions voluntary information	Not supported
Environmental Committee - H4: Firms with an environmental committee will disclose more information on GHG emissions.	Not supported
Ownership concentration - H5: There is a positive relationship between ownership concentration and GHG disclosure, ceteris paribus.	Supported
Director ownership - H6: There is a negative relationship between directors' share ownership and GHG information disclosure	Supported
Firm Characteristics	
Company size - H7: There is a significant positive relationship between size and the GHG disclosures	Supported
Gearing - H8: Highly geared firms are expected to disclose more GHG information	Not supported
Profitability - H9: There is a significant relationship between profitability and GHG disclosures	Not supported
Liquidity - H10: There is a significant positive relationship between liquidity and GHG disclosures	Not supported
Industry - H11: There is a positive association between Industry sector and GHG disclosures	Supported

The non-significance of most board characteristics raise questions regarding the effectiveness of existing board structures in GHG emission information user needs. On firm

characteristics, size and gearing have a significant relationship with voluntary GHG disclosures while profitability and liquidity had no significance.

When a list of determinants is put to senior executives of the companies through a survey questionnaire to examine whether any of the firm and governance characteristics influence the extent of disclosure, firm size and board environmental committee are the only determining factors to have received wide support by the respondents while all others were firmly rejected. The direct rejection of the characteristics may arguably suggest that determinants of financial disclosures are not necessarily the same as those of environmental disclosures (Guidry and Patten, 2012).

However the results turn out different when the regression output of the respondent firms is compared and contrasted to the survey outcome. The results indicated that the two research methods suggest that board size and proportion of non-executive directors are not significant determinants of GHG disclosure. However, the two research methods results differ in that while the quantitative approach indicate that ownership concentration and director ownership are significant negative determinants of GHG disclosure, our survey results suggest that the two corporate governance mechanisms are not significantly related to GHG disclosure. With regard to firm characteristics, only size was significant using both sets of data.

The consistent finding by both research approaches that both board size and proportion of non-executive directors do not determine the extent of GHG disclosure adds to growing empirical evidence that question the adequacy of existing board structures in serving wider needs including climate change. Consistent with this view, Wang and Hussainney (2013) argued that it is still debatable as to whether certain governance characteristics as advocated by UK corporate governance guidance are effective in improving narrative reporting in general. The contradicting evidence provided by the two research approaches in respect of ownership concentration and directors' share ownership suggests the need for further research in attempt to reconcile the differences. Particularly, what could be useful is not just a survey but also interviews so that reasons why such corporate governance variables appear not to be influential in determining GHG disclosure can be established.

9.3 Conclusion

By using both primary and secondary data from a sample of FTSE350 companies over a four year period i.e. 2008-2011, the study has investigated the extent and determinants of voluntary GHG emissions reporting. Overall the conclusion is that the extent of disclosure is

still low, it has an increasing trend and that both certain governance and firm characteristics have a significant role in defining the extent of the disclosures. More importantly through time effects the study has highlighted the role that government initiatives can play in influencing voluntary initiatives in company operations.

One main contribution of the study is first to exclusively look at the voluntary of GHG emissions determinants using both secondary and primary data and on a longitudinal basis. Many if not all the GHG disclosure studies have only concentrated on one period or just one source of data. With this uniqueness the study has been able to raise a number of critical questions regarding the efficacy of existing governance structures in addressing the question of GHG voluntary disclosures. Similarly the outcome of the primary data which rejected most of the financial characteristics has highlighted the need to carefully consider the role played by these determinants in GHG or environmental disclosures. Overall it is noted that the nature and design of the study enables it to make informed contribution to both knowledge and policy debate.

9.4 Recommendations

9.4.1 Policy development

To begin with the current study contributes to policy debate as to what needs to be done to ensure firms' adequate accountability and transparency in the area of climate change and GHG emissions. As countries strive to meet their own GHG emission reductions, their attention has been paid to role of companies in helping them meet the targets but the question that remains unresolved is whether regulatory tools should be used to accomplish this or good behaviour should be encouraged through voluntary initiatives. Therefore the study contributes to the on-going debate on efficacy of voluntary disclosures over mandatory disclosures in particular highlighting whether voluntary disclosures can be relied upon to provide adequate information to meet various stakeholder needs. Hess (2005) argued that voluntary disclosures often give an appropriate clue as to the extent to which mandatory guidelines may enforce compliance. This is especially important given that the UK government announced that GHG reporting is mandatory for all FTSE350 with effect from September 2013. The results of the panel fixed effects have clearly indicated the effect of time in the disclosure decisions with the period between 2009 and 2010 recording more increase than any other matched period in the time frame. Coincidentally this also happens to be the time when the government had stepped up its efforts in offering guidance regarding

measurement and reporting of GHG emissions. This coupled with the fact that other governance and firm characteristics have helped explain the voluntary disclosure of GHG emissions suggests that neither alone i.e. pseudo–regulatory guidelines such as DEFRA and market forces represented by the various corporate governance and company specific characteristics can satisfactorily encourage a firm to disclose information to meet stakeholder needs. In other words the results justify a form of intervention if the extent of voluntary disclosure is to be improved. This is in line with calls from previous studies (Kolk et al., 2008; Hrasky 2012).

On the same policy implication, the fact that both research approaches failed to establish a statistical relationship between two out of the four governance mechanisms investigated and GHG disclosures may suggest that authorities responsible for prescribing corporate governance mechanisms need to re-examine how such governance mechanisms could become more encompassing to serve the needs of wider stakeholders.

Besides, the use of both primary and secondary data enhances the credibility and richness with which our study can contribute to the policy debate. The study considers this as an important debate since most disclosure studies form the basis of regulatory intervention hence it is prudent that modelling involved should be grounded in sound theoretical framework. By incorporating primary data, the study also stand to make sound contribution to policy. One advantage of primary data is that it is able to obtain specific responses to a specific question unlike in secondary data where a proxy for say size might represent a number of things ranging from political costs, firm risk to environment influence (Graham *et al*., 2005). Thus, evidence abound that the understanding of company specific determinants of disclosure is of paramount importance in helping identify and highlight challenges or obstacles to the success of future regulatory efforts or policy (Peters and Romi, 2010). As May and Sundem (1976) suggest, policy adoption is as a result of the application of a choice among several alternatives and often a highly subjective judgemental process which in the opinion of Graham *et al.* (2005) can only have a sound grounding if supported by empirical evidence emanating from primary data. Thus the fact that both quantitative and survey results confirm the effect of company size suggest that there is merit in that any potential GHG disclosure regulation should take into account variations in company size.

The important of engaging practitioners in understanding the determinants of GHG disclosures in the UK needs no emphasis considering the leading role the UK has taken in the fight against climate change. Cormier et al. (2004) suggest that understanding managerial

perception can potentially help standard setters to better understand how to effect change in such disclosures. It also helps to understand why some information is disclosed by some firms and not others. This is especially important in the case of the UK which has taken a leading role in GHG management and reporting. For example, the UK Government was the first country in the world to pass a long-term legally binding framework to tackle the dangers of climate change in form of the Climate Change Act 2008. The Act set a legally binding target of at least an 80% cut in greenhouse gas emissions by 2050 and a reduction in emissions of at least 34% by 2020 against a 1990 baseline. Since then the UK government has taken a number of measures including issuing guidance on the way companies should report their greenhouse gas (GHG) emissions (DEFRA, 2009); publishing a review of the contribution the reporting of GHGs makes to emissions reductions (DEFRA, 2010) and announcement that from 2013 it will become mandatory for listed firms to report their GHGs in the annual report to ensure that it remains on course to meet targets set.

Particularly the results highlight specific areas that might require regulatory intervention to influence firms to be transparent in certain GHG emission information. Arnold and Mathews (2002) argued that *'...the nature and extent of supplementary disclosures influences and indicates the direction and scope of future legislation..'* The study precisely highlights areas that might need regulation emphasis. For instance quantitative data and data relating to climate change risks could be an area of regulatory emphasis. Considering that other respondents complained of lack of genuine interest by influential investors on GHG information, it is therefore intimated that mandatory reporting will remove uncertainty and push firms to invest more in systems that can enable them report more quantitative information.

9.4.2 Voluntary disclosure knowledge

In terms of the voluntary disclosure phenomenon, the study brings the understanding of GHG disclosure determinants on a longitudinal basis. As noted, voluntary disclosure literature is dominated by studies that have focussed on a single period (Bartlett and Jones, 1997). Over time attempts have been made to conduct studies on a longitudinal basis (see Choi, 1974; Firth, 1980; Barret, 1976). Recent studies on longitudinal basis include that of (Gray et al., 1995a; and Lee, 1994). However these longitudinal studies have not directly investigated the question of determinants (Bartlett and Jones, 1997). Therefore, this study which was done on a longitudinal basis using a modern form of annual report, covering a number of companies in diverse industries while maintaining a particular focus of voluntary disclosure has provided

useful insights to the general literature of disclosures since longitudinal studies tend to produce robust results (Oliveira et al., 2006). For instance the results have indicated an increasing trend but one where in some years the disclosures are simply a mirror/repetition of the prior year.

The relevance of longitudinal studies is well documented in literature. Brammer and Pavelin (2006) noted that a longitudinal study helps to highlight an evolving pattern of disclosure over time and the results of Rajab (2009) on risk disclosures in the UK, though done based on random years chosen over time supports this view. Other accounting disclosure studies particularly in social and environmental spheres have also displayed a pattern of increasing in response to a number of factors specifically regulation and public pressure (Haniffa and Cooke, 2005).

By testing primary data the study also makes a general contribution to the existing gaps in the disclosure literature. Deducing from the literature reviewed there is obviously a gap in literature regarding certain aspects of factors and motivation behind disclosures. In fact prior researchers (see Zarb, 2007) have called for more studies exploring the determinants and motivation behind disclosures arguing that despite many studies in this area the determinants and motives have not been satisfactorily defined (Hackston and Milne, 1996). Again Adams (2002) called for more studies testing primary data to reveal the motivation behind disclosures arguing that these voluntary disclosure motives or determinants cannot be obtained by testing secondary data alone of certain selected variables. Other prior studies like that of Gray et al. (2001) and Patten (2002) also argued that results from existing studies on disclosures particularly environmental information are inconclusive owing to many limitations of the studies and hence called for more studies in this area. Among the limitations cited are sample size and lack of industry diversity. The sample which comprised nine different industries from FTSE350 is considered diverse enough to give a clear picture of the voluntary GHG emission disclosure.

Finally, the study also contributes to the understanding of the extent of GHG voluntary disclosure practices by UK firms in the context of the requirements of a number of GHG disclosure guidance. Although there is growing research on GHG disclosures (e.g., Freedman and Jaggi, 2005; Peters and Romi, 2012; Rankin et al., 2011; Stanny, 2011) most of it is based on GRI (2002). It is therefore intimated that by measuring GHG voluntary disclosures based on a number GHG disclosure guidance is more appropriate in that it will

show the extent to which UK firms disclose internationally recommended GHG information on a voluntary basis.

9.5 Limitations of the Study and Suggestions for Future Research

One major limitation of the study relates to sample size for both secondary and primary data. First, the sample was extracted from FTSE 350 companies after excluding financial companies so the sample choice should be considered when drawing conclusions. Future research might extend the sample to include the financial companies and some medium and small companies since reporting of GHG emissions is expected from all regardless of the nature of its operations or size. The sample limitation is more pronounced in the survey respondents. The response rate of 62 companies which though at 28 per cent is considered adequate, constrain the extent to which we can generalise the findings. Future studies may also enhance their robustness by exploring interactive effects within the main variables of interest. This would help bring new insights in the GHG emission literature since from other prior disclosure other variables like size have also been found to playing a mediating role in the disclosure pattern. There is also scope for future studies to subdivide the sample and review whether disclosure pattern can be different between those in FTSE100 and those making up the remaining 250 companies in FTSE350. Such an approach could enrich understanding the role of size and scrutiny with regard to GHG emissions of companies making the top 100 in FTSE 350. Since mandatory policy is set in such a way to target large companies a study incorporating a subdivided sample of FTSE350 may help inform how policy can effectively be rolled out to companies beyond the FTSE 350 index.

Second, our analysis is restricted to disclosures made in annual reports and sustainability reports and no attempt has been made to compare these with what companies participating in other disclosure avenues like CDP make. Therefore future studies might compare these avenues in order to draw useful lessons. While the exclusion of CDP as an avenue was motivated by the desire to overcome many of its shortfalls, it is still recommended that such disclosures are considered if a complete picture of disclosure is to be established by the FTSE 350.

Another limitation relates to the fact that our triangulation made use of cross-sectional data, which meant we could not identify the dynamic effects among our determinants of GHG disclosure. While this was necessary due to the need to triangulate with the primary data, future research needs to track the pattern of disclosure over a period of time. Future work that also focuses on in-depth interviews might also bring useful insights as to whether

corporate governance mechanisms have any role to play in GHG disclosure. It is also possible that the findings of this study might be limited to the UK. Future studies should, therefore, investigate whether practitioners in other countries view these corporate governance mechanisms as influencing their GHG disclosure decisions. The focus on other countries is important in as far as results are concerned. As noted by Kolk (2010); Prado-Lorenzo et al. (2009), though climate change is a global problem, it affects countries differently as such policy guidance tends to reflect the effects experienced by a country and this may adversely affect international comparison. Gray et al. (1995a) in a review of environmental disclosure literature concluded in similar manner stating that a country of origin has a huge influence on disclosures. When researching on Corporate Social disclosures, Adams (2002) came to a similar conclusion. Other researchers have also singled out country of origin effects as a major limitation of international studies noting that voluntary disclosures are very much a reflection of mandatory disclosures which are heavily influenced by a country's legal system (Einhorn, 2005; Zarb, 2007; Holland and Foo, 2003). In direct reference to GHGs Peters and Romi (2010) argued that different countries continue to develop numerous reporting mechanisms for GHGs hence making firm or country comparison difficult. In the circumstances therefore it is recommended that similar studies focussing on different countries should be done rather than simply applying lessons learnt from this study.

The other limitation is the focus on the extent of voluntary disclosure itself. While this has unearthed viable information regarding the quantity of the information disclosed it did not confirm the quality or credibility of such disclosures. In other words such disclosures may not necessarily reflect the state of affairs in the company. It is therefore recommended that future studies should focus on the quality and credibility of such disclosures. This is important because in some prior studies there is evidence that most companies have been disclosing climate change and emission data just for legitimation purposes and not intending to demonstrate their true state of affairs (Hrasky, 2012).

While the disclosure index is considered broad based in this study compared to prior studies, it remains a self-constructed index which is prone to researcher subjectivity. Beattie et al. (2004) argued that studies with an already defined index risk overlooking other important elements of disclosure if they are not incorporated in the index. Since climate change and GHG emission is an evolving area, building on the constructed index in this study, future research may also concentrate on established a generally accepted index that

may limit subjectivity.

Again the study attempted to incorporate a number of governance and firm characteristics in its main model but the list of determinants is still not exhaustive. While it is not possible to exhaust all variables, future researchers are encouraged to incorporate as many variables as possible in a bid to enhance the understanding of the disclosure determinants. Alternatively studies may go further investigating the various characteristics of the governance determinants used here like environmental committee characteristics or the characteristics of the non-executive directors. Other factors like dual listing might also be incorporated to assess the impact of different listing jurisdictions on a firm's GHG emission disclosure pattern.

Finally, though the study investigated the question of disclosure determinants from a longitudinal focus, there is still scope to increase the period with which the phenomenon can be studied. Increasing the time frame together with the sample size may significantly improve the statistical power or robustness of the results.

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APPENDICES

Appendix I: Firm GHG disclosure and stakeholder importance

General instructions and information

This survey questionnaire is for academic purposes only. Therefore, all responses will be held in strict confidence. No individual will be identified.

Section A: Background information

1. **Please provide the following information:**

Information relating to yourself:

i) Name of company ……...

ii) Job title……

iii) Gender……

Please circle the appropriate answer relating to you in each of the columns in the table below:

iv) Your age (years)	**v) Your length of time in job (years)**	**vi) Your education**
a. ≤39	a. <4	a. GCSE or equivalent
b. 40–49	b. 4–9	b. University degree
c. 50–59	c. 10–15	c. MBA
d. 60+	d. >15	d. Non-MBA master's
		e. >Master's

Section B: Determinants of voluntary GHG disclosures

1. Please indicate the extent of your disagreement or agreement with each of the following statements.

The extent of voluntary GHG disclosures is influenced by;

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Board committee size	**1**	**2**	**3**	**4**	**5**
b. Audit committee size	**1**	**2**	**3**	**4**	**5**
c. Presence and proportion of non-executive directors on the board	**1**	**2**	**3**	**4**	**5**
d. presence of an sub-board committee on environment	**1**	**2**	**3**	**4**	**5**
e. separation of the roles of CEO and chairman	**1**	**2**	**3**	**4**	**5**
f. Institutional ownership i.e. majority of ordinary shares held by institutional investors	**1**	**2**	**3**	**4**	**5**
g. Insider ownership i.e. majority of ordinary shares held by managers/employees	**1**	**2**	**3**	**4**	**5**
h. foreign ownership	**1**	**2**	**3**	**4**	**5**
i. Size of your company	**1**	**2**	**3**	**4**	**5**
j. Company gearing i.e. capital structure	**1**	**2**	**3**	**4**	**5**
k. Company profitability	**1**	**2**	**3**	**4**	**5**
l. Company liquidity	**1**	**2**	**3**	**4**	**5**

m. Other (please specify)……

Thank you for taking the time to complete this questionnaire.

Your assistance in providing this information is very much appreciated.

If there are any comments you would like to make regarding this survey, please do so in the space provided below:

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Appendix Ib: Survey questionnaire introductory letter

To whom it may concern

The extent and motivation of Greenhouse Gas disclosures by Listed Companies in the United Kingdom

I am currently conducting a PhD research project on the extent and motivation of Greenhouse Gas (GHG) disclosures by listed companies on London Stock Exchange. The main objective of this research is to analyse the extent of GHG disclosures and understand the motivation behind the disclosures from people either directly or indirectly involved in the preparation of the disclosures.

I would be grateful if your company could participate in this survey. Your participation will provide invaluable input to the success of this study and further development of knowledge and understanding pertaining to the circumstances surrounding GHG information disclosures, as well as potentially assisting in policy formulation by government regulatory agencies and other interest groups.

All information will be treated as highly **CONFIDENTIAL** and used for academic purposes only. Should you wish to receive a summary of the results of this study please write your name and address at the end of the questionnaire. It will be forwarded to you at a later date.

Your cooperation is very much appreciated.

Sincerely

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Appendix 2:DEFRA 2009 Disclosure Requirements

	Recommended supporting disclosures	**Notes Section**
1	General company information Company information	Company information
2	State the reporting period covered	Reporting period
3	State the reason for any significant changes in emissions since previous year	Changes in emissions
4	State the measuring and reporting approach followed	Measuring and reporting approach
5	State the approach chosen to identify the operations you have collected data from	Organisational boundary
6	State the scopes included. Provide a list specifying the activity types included in each scope	Operational scopes
7	Provide detail of any specific exclusions of emissions from scopes 1 and 2 (including estimation of the % this is)	Operational scopes
8	Provide a brief explanation for the reason for any exclusions from scopes 1 and 2	Operational scopes
9	State the calculation approach used, specifically stating for each activity the % of activity data estimated	Operational scopes
10	State the conversion tools / emission factors you used	Operational scopes
11	Provide a breakdown by country of total GHG emissions	Geographical breakdown
12	Provide detail of any exclusions of countries if a global total is reported	Geographical breakdown
13	State the base year chosen and approach used to set the base year	Base year
14	State base year recalculation policy	Base year
15	State appropriate context for any significant emissions	Base year

	changes that trigger base year emissions recalculation (acquisitions/divestitures, outsourcing/in sourcing, changes in reporting boundaries or calculation methodologies, etc.).	
16	State your target, including scopes covered and target completion date. Provide a brief overview of progress towards target	Target
17	State the name of the person(s) responsible for achievement of this target and their position in your organisation	Target
18	State the reason for your intensity measurement choice	Intensity measurement
19	State the reason for any significant changes in your intensity measurement from the previous year	Intensity measurement
20	Provide an outline of any external assurance received and a copy of any assurance statement, if applicable	External Assurance Statement
21	For purchased carbon credits state the reduction in tonnes of CO2e per year	Carbon Offsetting
22	State the type of carbon credit (Kyoto compliant or non-Kyoto compliant credit) • If carbon credits are Kyoto-compliant, organisations should specify which external GHG programme has approved them, provide the name of the supplier and a hyperlink to the project documentation where possible • If carbon credits are non-Kyoto compliant, organisations should provide the name of the supplier, a hyperlink to the project documentation where possible, details of who developed the quantification methodology, how the project was validated and verified and how other 'good quality criteria' were met.	Carbon Offsetting
23	For purchased green tariffs state the reduction in tonnes of	Green tariffs

	CO2e per year	
24	State the supplier and the name of the tariff	Green tariffs
25	State the additional carbon saving associated with the tariff as a percentage (%)	Green tariffs
26	State in MWh the amount of electricity generated from owned or controlled sources. State if the owned or controlled source is onsite or offsite	Electricity generation
27	State if applicable in MWh the amount of own generated renewable electricity exported to the grid and if this is backed by REGOs within the UK.	Electricity generation
28	State the amount of incentive received (e.g. ROCs) if applicable	Electricity generation
29	State in MWh the amount of heat generated from owned or controlled sources. State if the owned or controlled source is offsite or onsite	Heat generation

Appendix 3: GHG Protocol (2004) disclosure requirements

	Disclosure requirement	**Type of disclosure**
	a) Description of the company and inventory boundary	
1	An outline of the organizational boundaries chosen, including the chosen consolidation approach	Recommended information
2	An outline of the operational boundaries chosen, and if scope 3 is included, a list specifying which types of activities are covered.	Recommended information
3	The reporting period covered	Recommended information
	b) Information on emissions	
4	Total scope 1 and 2 emissions independent of any GHG trades such as sales, purchases, transfers, or banking of allowances.	Recommended information
5	Emissions data separately for each scope.	Recommended information
6	Emissions data for all six GHGs separately (CO**2**, CH**4**, N**2**O, HFCs, PFCs, SF**6**) in metric tonnes and in tonnes of CO**2** equivalent.	Recommended information
7	Year chosen as the base year, and an emissions profile over time that is consistent with and clarifies the chosen policy for making base year emissions recalculations.	Recommended information
8	Appropriate context for any significant emissions changes that trigger base year emissions recalculation (acquisitions/divestitures, outsourcing/insourcing, changes in reporting boundaries or calculation methodologies, etc.).	Recommended information

9	Emissions data for direct CO**2** emissions from biologically sequestered carbon (e.g., CO**2** from burning biomass/biofuels), reported separately from the scopes.	Recommended information
10	Methodologies used to calculate or measure emissions, providing a reference or link to any calculation tools used.	Recommended information
11	Any specific exclusions of sources, facilities, and / or operations.	Recommended information
	(a) Information on emissions and performance	
12	Emissions data from relevant scope 3 emissions activities for which reliable data can be obtained.	Optional
13	Emissions data further subdivided, where this aids transparency, by business units/facilities, country, source types (stationary combustion, process, fugitive, etc.), and activity types (production of electricity, transportation, generation of purchased electricity that is sold to end users, etc.).	Optional
14	Emissions attributable to own generation of electricity, heat, or steam that is sold or transferred to another organization.	Optional
15	Emissions attributable to the generation of electricity, heat or steam that is purchased for re-sale to non-end users.	Optional
16	A description of performance measured against internal and external benchmarks.	Optional
17	Emissions of GHGs not covered by the Kyoto Protocol (e.g., CFCs, NO**x**,), reported separately from scopes.	Optional
18	Relevant ratio performance indicators (e.g. emissions per kilowatt-hour generated, tonne of Material production, or sales).	Optional
19	An outline of any GHG management/reduction programs	Optional

	or strategies.	
20	Information on any contractual provisions addressing GHG-related risks and obligations.	Optional
21	An outline of any external assurance provided and a copy of any verification statement, if applicable, of the reported emissions data.	Optional
22	Information on the causes of emissions changes that did not trigger a base year emissions recalculation (e.g., process changes, efficiency improvements, plant closures).	Optional
23	GHG emissions data for all years between the base year and the reporting year (including details of and reasons for recalculations, if appropriate)	Optional
24	Information on the quality of the inventory (e.g., information on the causes and magnitude of Uncertainties in emission estimates) and an outline of policies in place to improve inventory quality.	Optional
25	Information on any GHG sequestration.	Optional
26	A list of facilities included in the inventory.	Optional
27	A contact person.	Optional
	(b) Information on Offsets	
28	Information on offsets that have been purchased or developed outside the inventory boundary, subdivided by GHG storage/removals and emissions reduction projects. Specify if the offsets are verified/certified and/or approved by an external GHG program (e.g., the Clean Development Mechanism, Joint Implementation).	Optional
29	Information on reductions at sources inside the inventory boundary that have been sold/transferred as offsets to a	Optional

	third party. Specify if the reduction has been verified/certified and/or approved by an external GHG program.	

Appendix 4: Carbon Disclosure Standards Board (2010)

	Disclosure requirement	**Notes/Comments**
	Strategic analysis, risk and governance	
1	Strategic analysis - Disclosure about strategic analysis shall include a statement about the long-term and short term impact climate change actually and potentially has on the organization's strategic objectives.	
2	Risks - Disclosure about risks shall include an explanation and qualitative assessment of the organization's exposure to current and anticipated (long term and short-term) significant risks associated with climate change.	
3	Opportunities - Disclosure about opportunities shall include an explanation and qualitative assessment of current and anticipated (long-term and short term) significant opportunities associated with climate change	
4	Management actions - Disclosure shall include a description of the organization's long-term and short-term strategy or plan to address climate change-related risks, opportunities and impacts, including targets to reduce GHG emissions and an analysis of performance against those targets.	
5	Future outlook - Disclosures shall include information about the future outlook, long-term and short term, including trends and factors related to climate change that are likely to affect management's view of the organization's strategy or the timescales over which achievement of the strategy is typically planned	
6	Governance - Disclosures shall describe the governance processes and organizational resources that have been assigned to the identification, management and governing	

	body oversight of climate change-related issues.	
	Greenhouse Gas Emissions	
	Part 2 GHG emissions (Scope 1 and Scope 2) Part 2 GHG emissions should include emissions from operationally controlled and/or other entities/activities/facilities that:	
7	are not consolidated in Part 1; and	
8	must be reported under regulatory requirements by the disclosing organization in its capacity as operating licensee or in any other capacity (e.g.: tenant); or	
	Other indirect GHG emissions (Scope 3)	Scope 3 GHG emissions are not required by CDSB (2010) but where Scope 3 emissions expose the reporting organization to risks, opportunity or financial impacts, the effect should be disclosed under the Strategic Analysis, Risk and Governance.
	Once the reporting categories/boundaries are determined, an entity shall disclose the following:	
9	Gross absolute Part 1 and Part 2 GHG emissions shall be calculated by reference to one or more recognized GHG emissions reporting schemes and disclosed in CO2	

	equivalent metric tones	
10	Normalized GHG emissions shall be disclosed for the organization i.e. Normalized GHG emissions = Absolute GHG emissions /output (physical or economic	
11	GHG emissions results shall be accompanied by contextual disclosures that include: a. the name or names of the recognized GHG emissions reporting scheme(s) used to calculate GHG emissions; b. the quantification methodology used for calculating GHG emissions. c. key assumptions made in the preparation of disclosures; d. emission factors and/or the source of emission factors used to calculate GHG emissions from activity data; e. the global warming potentials (GWP) used and their source; f. in support of Scope 2 (indirect) GHG emissions results, disclose details (in KWh, MWh or GWh) of the purchased electricity the organization has consumed; g. a description of the main effects of uncertainty in the calculation of GHG emissions e.g.: data gaps, assumptions, extrapolations, metering/measurement inaccuracies etc.; h. a statement on whether and to what extent GHG emissions results have been verified or assured in house or by an independent third party; i. confirmation or otherwise that Scope 1 and 2 GHG emissions results relate to activities and sources within the	

	organizational boundaries.	
12	Movements in GHG emissions results over time shall be disclosed and explained.	

Appendix 5: GHG Disclosure Score Index

	GHG Disclosure Score Index	
	Disclosure item	**Score**
	Qualitative Disclosures	
1	Institutional background	1
2	Period covered by the report	1
3	Statement on company position on climate change and related responsibilities	1
4	Corporate governance on climate change	1
5	Climate change opportunities and company strategies	1
6	Climate change impact on business operations including supply chains	1
7	Identification of regulatory risks as a result of climate change	1
8	Identification of all other risks as a result of climate change	1
9	Actions/measures taken to reduce/mitigate climate change impact	1
10	Adaptation strategies to climate change effects	1
11	Regulated Schemes to which a firm belongs	1
12	Reporting Guidelines used in GHG reporting	1
13	An assurance statement on disclosed information	1
14	Contact or responsible person for GHG reporting	1
15	Organisation boundary and consolidation approach	1
16	Base Year	1
17	Explanation for a change in base year	1
18	GHGs covered including those not required by Kyoto protocol	1
19	Sources and sinks used/excluded	1
20	Conversion factors used/methodology used to measure or calculate emissions	1
21	Explanation for any changes to methodology or conversion factors previously used	1
22	A list of facilities included in the inventory for GHG emissions	1
23	Information on the quality of the inventory e.g. causes and magnitude of uncertainties in estimates	1
24	Information on any GHG sequestration	1
25	Disclosure of the supplier and the name of the purchased green tariff	1
26	Explanations for changes in performance of total GHG emissions in Co2 metric tonnes	1
27	Explanation of any country excluded if global total is reported	1
28	Explanations for changes in performance of scope 1 emissions	1
29	Details of any specific exclusion of emissions from scope 1	1
30	Explanation for the reason of any exclusion from scope 1	1

31	Explanations for changes in performance of scope 2 emissions	1
32	Details of any specific exclusion of emissions from scope 2	1
33	Explanation for the reason of any exclusion from scope 2	1
34	Explanations for changes in performance of scope 3 emissions	1
	Quantitative Disclosures	
35	Total GHG emissions in Co2 metric tonnes	1
36	Comparative data of Total GHG emissions in Co2 metric tonnes	1
37	Future estimates of total GHG emissions in Co2 metric tonnes	1
38	GHG emission by business unit/type/country	1
39	GHG removals quantified in tonnes of Co2e	1
40	Scope 1 emissions	1
41	Comparative data on scope 1 emissions	1
42	Future estimates of scope 1 emissions	1
43	Scope 2 emissions	1
44	Comparative data on scope 2 emissions	1
45	Future estimates of scope 2 emissions	1
46	Scope 3 emissions	1
47	Comparative data on scope 3 emissions	1
48	Future estimates of scope 3 emissions	1
49	Emission of direct Co2 reported separately from scopes	1
50	Emission not covered by Kyoto and reported separately from scopes	1
51	Emission attributable to own generation of electricity/heat/steam sold or transferred to another orgn	1
52	Emission attributable to own generation of electricity/heat/steam purchased for resale to end users	1
53	For purchased green tariff state the reduction in tonnes of Co2e per year	1
54	Additional carbon saving associated with the tariff as a percentage	1
55	Quantitative data estimates of the regulatory risks as a result of climate change	1
56	Quantitative data estimates of all other risks as a result of climate change	1
57	GHG emission performance measurement against internal and external benchmarks including ratios	1
58	GHG emission targets set and achieved	1

59	GHG emission offsets information	1
60	Comparative information on targets set and achieved	1
	Maximum Disclosure Score	**60**

Appendix 6: List of companies used in the sample

	List of FTSE350 Companies making up the study sample		
	Company	**Sector**	**Industry**
1	BAE Systems	Aerospace and Defence	Industrials
2	Chemring Group	Aerospace and Defence	Industrials
3	Cobham	Aerospace and Defence	Industrials
4	Meggitt	Aerospace and Defence	Industrials
5	Qinetiq Group	Aerospace and Defence	Industrials
6	Rolls-Royce Holdings	Aerospace and Defence	Industrials
7	Senior	Aerospace and Defence	Industrials
8	Ultra Electronics Holdings	Aerospace and Defence	Industrials
9	GKN	Automobiles and Parts	Consumer Goods
10	Barr (A.G.)	Beverages	Consumer Goods
11	Britvic	Beverages	Consumer Goods
12	Diageo	Beverages	Consumer Goods
13	SABMiller	Beverages	Consumer Goods
14	Croda International	Chemicals	Basic Materials
15	Elementis	Chemicals	Basic Materials
16	Johnson Matthey	Chemicals	Basic Materials
17	Victrex	Chemicals	Basic Materials
18	Yule Catto & Co.	Chemicals	Basic Materials
19	Balfour Beatty	Construction and Materials	Industrials
20	Galliford Try	Construction and Materials	Industrials
21	Kier Group	Construction and Materials	Industrials
22	Drax Group	Electricity	Utilities
23	Domino Printing Sciences	Electronic and Electrical Equipment	Industrials
24	Halma	Electronic and Electrical Equipment	Industrials
25	Morgan Crucible Co.	Electronic and Electrical Equipment	Industrials
26	Oxford Intruments	Electronic and Electrical Equipment	Industrials
27	Renishaw	Electronic and Electrical Equipment	Industrials
28	Spectris	Electronic and Electrical Equipment	Industrials
29	BT Group	Fixed Line Telecommunication	Telecommunications
30	Colt Group SA	Fixed Line Telecommunication	Telecommunications
31	KCOM Group	Fixed Line Telecommunication	Telecommunications
32	TalkTalk Telecom Group	Fixed Line Telecommunication	Telecommunications

33	Booker Group	Food and Drug Retailers	Consumer Services
34	Greggs	Food and Drug Retailers	Consumer Services
35	Morrisons	Food and Drug Retailers	Consumer Services
36	Ocado Group	Food and Drug Retailers	Consumer Services
37	Sainsbury	Food and Drug Retailers	Consumer Services
38	Tesco	Food and Drug Retailers	Consumer Services
39	Associated British Foods	Food Producers	Consumer Goods
40	Cranswick	Food Producers	Consumer Goods
41	Dairy Crest Group	Food Producers	Consumer Goods
42	Devro	Food Producers	Consumer Goods
43	Premier Foods	Food Producers	Consumer Goods
44	Tate & Lyle	Food Producers	Consumer Goods
45	Unilever	Food Producers	Consumer Goods
46	Mondi	Forestry and Paper	Basic Materials
47	Centrica	Gas, Water and Multiutilities	Utilities
48	International Power	Gas, Water and Multiutilities	Utilities
49	National Grid	Gas, Water and Multiutilities	Utilities
50	Northambrian Water Group	Gas, Water and Multiutilities	Utilities
51	Pennon Group	Gas, Water and Multiutilities	Utilities
52	Severn Trent	Gas, Water and Multiutilities	Utilities
53	United Utilities Group	Gas, Water and Multiutilities	Utilities
54	Cookson Group	General Industrials	Industrials
55	RPC Group	General Industrials	Industrials
56	Rexam	General Industrials	Industrials
57	Smith (DS)	General Industrials	Industrials
58	Smiths Group	General Industrials	Industrials
59	Brown Group	General Retailers	Consumer Services
60	Carpetright	General Retailers	Consumer Services
61	Debenhams	General Retailers	Consumer Services
62	Dignity	General Retailers	Consumer Services
63	Dixons Retail	General Retailers	Consumer Services
64	Dunelm Group	General Retailers	Consumer Services
65	Halfords Group	General Retailers	Consumer Services
66	Home Retail Group	General Retailers	Consumer Services
67	Inchcape	General Retailers	Consumer Services
68	JD Sports Fashion	General Retailers	Consumer Services
69	Kesa Electricals	General Retailers	Consumer Services

70	Kingfisher	General Retailers	Consumer Services
71	Marks & Spencer	General Retailers	Consumer Services
72	Mothercare	General Retailers	Consumer Services
73	Next	General Retailers	Consumer Services
74	Sports Direct	General Retailers	Consumer Services
75	WH Smith	General Retailers	Consumer Services
76	Smith & Nephew	Health Care Equipment and Services	Health Care
77	Barratt Developments	Household Goods	Consumer Goods
78	Bellway	Household Goods	Consumer Goods
79	Berkeley Group Holdings	Household Goods	Consumer Goods
80	Bovi Homes Group	Household Goods	Consumer Goods
81	Persimmon	Household Goods	Consumer Goods
82	Reckitt Benckiser	Household Goods	Consumer Goods
83	Redrow	Household Goods	Consumer Goods
84	Taylor Wimpey	Household Goods	Consumer Goods
85	Bodycote	Industrial Engineering	Industrials
86	Fenner	Industrial Engineering	Industrials
87	IMI	Industrial Engineering	Industrials
88	Melrose	Industrial Engineering	Industrials
89	Rotork	Industrial Engineering	Industrials
90	Spirax-Sarco Engineering	Industrial Engineering	Industrials
91	Weir	Industrial Engineering	Industrials
92	Ferrexpo	Industrial Metals	Basic Materials
93	BBA Aviation	Industrial Transportation	Industrials
94	Stobart Group	Industrial Transportation	Industrials
95	Aegis Group	Media	Consumer Services
96	British Sky Broadcasting Group	Media	Consumer Services
97	Daily Mail & General Trust	Media	Consumer Services
98	Euromoney Institutional Investors	Media	Consumer Services
99	ITE Group	Media	Consumer Services
100	ITV	Media	Consumer Services
101	Informa	Media	Consumer Services
102	Pearson	Media	Consumer Services
103	Reed Elsevier	Media	Consumer Services
104	Rightmove	Media	Consumer Services

105	UBM	Media	Consumer Services
106	WPP	Media	Consumer Services
107	Allied Gold Mining	Mining	Basic Materials
108	Anglo American	Mining	Basic Materials
109	Antofagasta	Mining	Basic Materials
110	BHP Billiton	Mining	Basic Materials
111	Centamin Egypt	Mining	Basic Materials
112	Eurasian Natural Resources	Mining	Basic Materials
113	Fresnillo	Mining	Basic Materials
114	Gem Diamonds	Mining	Basic Materials
115	Hochschild Mining	Mining	Basic Materials
116	Kazakhmys	Mining	Basic Materials
117	Kenmare Resources	Mining	Basic Materials
118	Lonmin	Mining	Basic Materials
119	New World Resources	Mining	Basic Materials
120	Petropavlovsk	Mining	Basic Materials
121	Randgold Resources	Mining	Basic Materials
122	Rio Tinto	Mining	Basic Materials
123	Talvivaara Mining Company	Mining	Basic Materials
124	Vedanta Resources	Mining	Basic Materials
125	Xstrata	Mining	Basic Materials
126	Inmarsat	Mobile Telecommunications	Telecommunications
127	Vodafone Group	Mobile Telecommunications	Telecommunications
128	Afren	Oil and Gas producers	Oil and Gas
129	BG Group	Oil and Gas producers	Oil and Gas
130	BP	Oil and Gas producers	Oil and Gas
131	Carn Energy	Oil and Gas producers	Oil and Gas
132	Exillon Energy	Oil and Gas producers	Oil and Gas
133	Heritage Oil	Oil and Gas producers	Oil and Gas
134	Premier Oil	Oil and Gas producers	Oil and Gas
135	Royal Dutch Shell A	Oil and Gas producers	Oil and Gas
136	Salamander Energy	Oil and Gas producers	Oil and Gas
137	Soco International	Oil and Gas producers	Oil and Gas
138	Tollow Oil	Oil and Gas producers	Oil and Gas
139	Hunting	Oil Equipment, Services and Distribution	Oil and Gas
140	Kentz Corporation	Oil Equipment, Services and Distribution	Oil and Gas
141	Lamprell	Oil Equipment, Services and Distribution	Oil and Gas

142	Petrofac	Oil Equipment, Services and Distribution	Oil and Gas
143	Wood Group (John)	Oil Equipment, Services and Distribution	Oil and Gas
144	Amec	Oil Equipment, Services and Distribution	Oil and Gas
145	Burberry Group	Personal Goods	Consumer Goods
146	PZ Cussons	Personal Goods	Consumer Goods
147	AstraZeneca	Pharmaceticals and Biotechnology	Health Care
148	BTG	Pharmaceticals and Biotechnology	Health Care
149	Genus	Pharmaceticals and Biotechnology	Health Care
150	GlaxoSmithKline	Pharmaceticals and Biotechnology	Health Care
151	Hikma Pharmaceuticals	Pharmaceticals and Biotechnology	Health Care
152	Shire	Pharmaceticals and Biotechnology	Health Care
153	Aveva Group	Software and Computer Services	Technology
154	Computacenter	Software and Computer Services	Technology
155	Fidessa Group	Software and Computer Services	Technology
156	Invensys	Software and Computer Services	Technology
157	Logica	Software and Computer Services	Technology
158	Microfocus International	Software and Computer Services	Technology
159	SDL	Software and Computer Services	Technology
160	Sage Group	Software and Computer Services	Technology
161	Telecity Group	Software and Computer Services	Technology
162	Aggreko	Support Services	Industrials
163	Ashtead Group	Support Services	Industrials
164	Atkins (WS)	Support Services	Industrials
165	Babcock International Group	Support Services	Industrials
166	Berendsen	Support Services	Industrials
167	Bunzl	Support Services	Industrials
168	Capita Group	Support Services	Industrials
169	Carillion	Support Services	Industrials
170	De la Rue	Support Services	Industrials
171	Electrocomponents	Support Services	Industrials
172	Experian	Support Services	Industrials
173	Filtrona	Support Services	Industrials
174	G4S	Support Services	Industrials
175	Hays	Support Services	Industrials
176	Homeserve	Support Services	Industrials
177	Interserve	Support Services	Industrials
178	Intertek Group	Support Services	Industrials

179	MITIE Group	Support Services	Industrials
180	Michael Page International	Support Services	Industrials
181	Northgate	Support Services	Industrials
182	Premier Farnell	Support Services	Industrials
183	RPS	Support Services	Industrials
184	Regus	Support Services	Industrials
185	Rentokil Initial	Support Services	Industrials
186	SIG	Support Services	Industrials
187	Sthree	Support Services	Industrials
188	Serco Group	Support Services	Industrials
189	Shanks Group	Support Services	Industrials
190	Travis Perkins	Support Services	Industrials
191	ARM Holdings	Technology Hardware and Equipment	Technology
192	Imagination Technologies Group	Technology Hardware and Equipment	Technology
193	Laird	Technology Hardware and Equipment	Technology
194	Pace	Technology Hardware and Equipment	Technology
195	Spirent Communication	Technology Hardware and Equipment	Technology
196	British American Tobacco	Tobacco	Consumer Goods
197	Imperial Tobacco Group	Tobacco	Consumer Goods
198	Carnival	Travel and Leisure	Consumer Services
199	Compass Group	Travel and Leisure	Consumer Services
200	Easyjet	Travel and Leisure	Consumer Services
201	FirstGroup	Travel and Leisure	Consumer Services
202	Go-Ahead Group	Travel and Leisure	Consumer Services
203	Greene King	Travel and Leisure	Consumer Services
204	InterContinental Hotels Group	Travel and Leisure	Consumer Services
205	Ladbrokes	Travel and Leisure	Consumer Services
206	Marstons	Travel and Leisure	Consumer Services
207	Millennium & Copthorne Hotels	Travel and Leisure	Consumer Services
208	National Express Group	Travel and Leisure	Consumer Services
209	Restaurant Group	Travel and Leisure	Consumer Services
210	Stagecoach Group	Travel and Leisure	Consumer Services
211	TUI Travel	Travel and Leisure	Consumer Services
212	Thomas Cook Group	Travel and Leisure	Consumer Services
213	Wetherspoon (JD)	Travel and Leisure	Consumer Services

214	Whitbread	Travel and Leisure	Consumer Services
215	William Hill	Travel and Leisure	Consumer Services