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The current status of greenhouse gas reporting by Chinese companies

A test of legitimacy theory

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Abstract

Purpose – The purpose of this paper is to investigate the factors driving greenhouse gas reporting by Chinese companies.

Design/methodology/approach – Content analysis of annual reports and corporate social responsibility (CSR) reports for the year 2010 of the top 100 A-share companies listed on Shanghai Stock Exchange was conducted to investigate the extent of greenhouse gas reporting. Multiple regression analysis was performed to determine the factors driving these companies' greenhouse gas reporting.

Findings – It was found that most Chinese companies reported neutral and good news. The results also indicate larger companies operating in an industry which has higher level of carbon dioxide emissions tend to have higher levels of greenhouse gas disclosures, consistent with the expectation of legitimacy theory. However, profitability and overseas listing were not significantly related to greenhouse gas reporting. This is consistent with the findings of previous literature. Finally, contrary to expectations, state-owned companies report less greenhouse gas information than private companies.

Originality/value – The paper contributes towards theory development by testing legitimacy theory in the context of greenhouse gas reporting by Chinese companies and contributes to existing literature on greenhouse gas reporting by focussing on the large emerging economy of China. The practical contribution of the paper rests in the area of accounting practice. The results outline the dearth in greenhouse gas reporting by Chinese companies, suggesting there needs to be future development of accounting standards in this area.

Keywords China, Corporate governance, Accounting standards, Global warming, Greenhouse gas reporting, Chinese companies

Paper type Research paper

1. Introduction

In recent years, the detrimental effect of greenhouse gas has raised commentary on the balance between economic development and environmental protection (Ceng, 2010; Xu and Yang, 2010). The Kyoto Protocol (2005) urged major developed countries to reduce their carbon dioxide emissions to by about 5.2 percent before 2012 compared to the 1990 level (Wei, 2007). The world business summit on climate change, held at Copenhagen in 2009, further stressed the importance of a low carbon economy. The significance of China in reducing global carbon emissions is evidenced by the fact that it is still the second-largest contributor of CO₂ in the world (Liu and Diamond, 2005) and is ranked second in the world in terms of total gross domestic product (GDP) (Mendleson, 2010).

According to the National Development and Reform Commission (2007) greenhouse gas emissions in 1994 in China amounted to 4.06 billion tons, which included 3.07 billion tons of CO₂. During 2004, greenhouse gas emissions had increased to 6.1 billion tons that included CO₂ emissions of 5.07 billion tons. From 1994 to 2004, CO₂ emissions as a proportion of total greenhouse gas emissions had increased from 76 to 83 percent (National Development and Reform Commission, 2007).

The high level of CO₂ emissions in China arises from its need for energy sources (National Development and Reform Commission, 2007). About 70 percent of total energy production in China comes from coal, resulting in 90 percent of total CO₂ emissions in the country (Mo, 2008). If CO₂ emissions increase at the current rate, it is expected that CO₂ emissions in China will exceed ten billion tons by 2020 and 12.2 billion tons by 2050 (Energy Research Institute of National Development and Reform Commission, 2009).

Following worldwide environmental awareness programs, China has committed itself to being a “low carbon economy” (Bai and Feng, 2010, p. 10). At the world business summit on climate change held in Copenhagen, the Chinese Government agreed to reduce the country’s CO₂ emissions by 2020 by at least 45 percent of the 2005 level (The People’s Daily, 2010). Following such agreement at the international level, laws, regulations and policies were passed in the country to promote energy conservation and reduce CO₂ emissions. Both the Kyoto Protocol and the Copenhagen Accord have sought ways to decrease CO₂ emissions and slow down the level of climate change (United Nations, 1997, 2009). However, studies on climate change disclosure are limited, predominantly focussing on developed countries (Freedman and Jaggi, 2011; Haque and Deegan, 2010; Kolk et al., 2008). This is a critical limitation as Chinese companies will largely shape the effect of greenhouse gas emissions throughout the world (Bagnai, 2009; Liu and Diamond, 2005). This study somewhat mitigates this limitation by investigating the current status of greenhouse gas reporting by Chinese companies, particularly contributing towards theoretical development by testing legitimacy theory in the context of greenhouse gas reporting in an emerging economy. It also considers the future development of greenhouse gas-related reporting standards in light of the scarcity of this reporting by Chinese companies.

This paper is organized into nine sections. Section 2 explores previous corporate greenhouse gas reporting literature and Section 3 outlines the appropriateness of legitimacy theory as the theoretical framework for this study. This is followed by Section 4 which elucidates the greenhouse gas reporting regulations in China and Section 5 which develops the hypotheses. Section 6 then explains the “research method” and Section 7 presents the results before Section 8 concludes the study. Finally, an outline of “limitations and directions for future research” is considered in Section 9.

2. Literature review

There is increasing interest in the area of environmental disclosures (Deegan, 2002). However, greenhouse gas reporting is a relatively new concept in the accounting literature (Choi et al., 2010). Haque and Deegan (2010) examined the disclosure of climate change policy and procedure by five major Australian energy-intensive companies, namely BHP Billiton, Caltex, Origin Energy Limited, Rio Tinto and Santos Limited from 1992 to 2007. Their study reported an increase in corporate reporting over this period. However, no company disclosed information across all categories of climate change policy and procedures, which comprised the following items: broad oversight; senior management engagement and

responsibility; emissions accounting; research and development; potential liability reduction reporting; carbon pricing and trading; and external affairs.

Choi et al. (2010) investigated the extent and quality of carbon emissions reporting by 100 Australian companies. Consistent with legitimacy theory expectations, these authors reported that firms used carbon reporting as a tool to achieve legitimacy. Their results revealed that the key factors affecting the quality of voluntary carbon emission disclosures were firms' size and return on assets (ROA). Their finding also revealed that carbon emission disclosures were higher for companies operating in an industry which was highly sensitive to environment than those not in an environmentally sensitive industry. Kim and Lyon (2010) examined the motivation behind firms' disclosure of greenhouse gas reduction to the US Government. The authors found the main motivation for these voluntary greenhouse gas reduction disclosures was receipt of the early reduction credit on greenhouse gas emissions. US companies have the option to provide greenhouse gas information through the Carbon Disclosure Project (CDP, 2009), which is an independent non-profit organization that encourages disclosure of greenhouse emissions and climate change strategies of major corporations around the world. Stanny and Ely (2008) investigated factors driving US S&P 500 companies to disclose greenhouse gas information through the CDP. Their study reported that firm size, previous disclosures and foreign sales were related to voluntary disclosure. A negative relationship was reported between high level of institutional ownership, newer assets that is, capital expenditure and higher level of intangible assets with greenhouse gas reporting.

Freedman and Jaggi (2011) investigated the relationship between the ratification of the Kyoto Protocol, greenhouse gas performance and greenhouse gas reporting. These authors conducted a content analysis involving 510 firms belonging to various industries across Europe, Japan, Canada, India and the USA. Their study reported that companies operating in a country that ratified the protocol tended to disclose more, except for Indian companies. However, there was no significant relationship between greenhouse gas emission performance and greenhouse gas disclosure.

A similar study was done by Prado-Lorenzo et al. (2009). The study analysed the factors driving greenhouse gas and climate change reporting by examining the web sites of 101 firms from different countries and industries. Their study reported that firm size, industry sector, ratification of the protocol by the country that companies were located in and economic performance were all related to greenhouse gas reporting. The authors suggested that the largest companies located in a country ratifying the protocol and with less favourable income reported higher level of greenhouse gas information.

The studies mentioned above (Choi et al., 2010; Haque and Deegan, 2010; Kim and Lyon, 2010; Stanny and Ely, 2008; Prado-Lorenzo et al., 2009) concentrated, for the most part, on developed economies, while that of Freedman and Jaggi (2011) investigated greenhouse gas reporting by an emerging economy – that of India. This latter study investigated only the relationship between ratification of the Kyoto Protocol, greenhouse gas performance and greenhouse gas reporting. The authors suggest that the larger companies with less favourable incomes in countries ratifying the protocol reported higher levels of greenhouse gas information.

Following the relatively little research investigating factors determining greenhouse gas reporting by companies operating in emerging economies, the present study investigates the factors driving greenhouse gas reporting by Chinese companies.

3. Theoretical framework

Previous literature investigating corporate environmental reporting in developed economies suggests that the principal reason behind such reporting is to gain legitimacy (Deegan and Gordon, 1996; Deegan and Rankin, 1996; Mitchell et al., 2006; Cowan and Deegan, 2010; Brown and Deegan, 1998; Deegan et al., 2002; O'Donovan, 2002; Tilling and Tilt, 2010; Gray et al., 1995; Campbell, 2003; Solomon and Lewis, 2002). There are limited studies that investigated corporate environmental reporting in emerging economies. In emerging economy context, Sahay (2004) and Chatterjee and Mir (2008) submit that the principal reason behind corporate environmental reporting by Indian companies is to gain legitimacy. However, the findings of Clarkson et al. (2008) did not support this proposition in regard to corporate environmental reporting of US companies. Further, Ahmed and Sulaiman (2004) report limited support of legitimacy theory for corporate environmental reporting of Malaysian companies.

Following the wide-spread adoption of legitimacy theory in explaining corporate environmental reporting, the present study adopts this theory for its theoretical framework. Legitimacy theory is derived from political economy theory (Gray et al., 1996). Guthrie and Parker (1990, p. 166) stated that "[...] the political economy perspective perceives accounting reports as social, political, and economic documents". Companies use annual reports as tools to legitimise themselves. There is a social contract between companies and the society. Hearit (1995, p. 2) explained that "legitimacy functions as an organizational resource". In a dynamic society, organizations cannot survive without resource from the members of the society (Patten, 1992). If the social contract is breached, society's expectations are not fulfilled (Mitchell et al., 2006) resulting in a legitimacy gap (Wilmshurst and Frost, 2000). The legitimacy gap may affect the ability of the company to continue operating (Deegan, 2009).

Legitimacy theory can be differentiated from other theories that fall under the umbrella of political economy theory. In contrast to the survival premise of legitimacy theory, managerial stakeholder theory orientates its constructs on the premise that entities disclose information to manage their relationship with influential stakeholder groups. Furthermore, it adopts ethical stakeholder theory because it assumes that all stakeholder groups have the right to be provided with information (Roberts, 1992; Brammer and Pavelin, 2006; Isack and Tan, 2008). Institutional theory is more specific than legitimacy theory in that it views disclosure as a tool to respond to institutional pressures rather than in terms of closing a legitimacy gap (Cormier et al., 2005; Kolk, 2005; Amran and Devi, 2008; Amran and Siti-Nabiha, 2009; Amran and Haniffa, 2011).

Lindblom (1994) identified four organizational strategies to close the legitimacy gap such as, "changing the organization" or "changing the public, manipulation and misrepresentation" of the organization. "Changing the organization" refers to providing an impression to the public that the organization has changed, while "changing the public" denotes changing the perception of the public without any change to the operation of the organization.

"Manipulation" refers to diverting the attention of the public. For example, tobacco companies highlight links with charity in order to deflect the public's attention from health issues relating to smoking (Tilling and Tilt, 2010). Finally, "misrepresentation" refers to misrepresentation of facts to gain legitimacy. There is support of the "manipulation" strategy in regard to environmental reporting in the previous literature (Deegan and Gordon, 1996; Deegan and Rankin, 1996; Mitchell et al., 2006; Cowan and Deegan, 2010;

Brown and Deegan, 1998; Deegan et al., 2002; O'Donovan, 2002; Tilling and Tilt, 2010; Campbell, 2003; Brammer and Pavelin, 2008; Hughes et al., 2001; Chatterjee and Mir, 2008). As outlined above, based on legitimacy theory it is expected that Chinese companies will report greenhouse gas information in their annual reports. This is due to the high emphasis placed by the Chinese Government on reducing greenhouse gas, which has resulted in high awareness of the issue in Chinese society. China's commitment is evidenced by the promise in the Copenhagen climate change conference to reduce carbon dioxide emissions per unit of GDP by 40-45 percent in 2020 compared to the 2005 level (The People's Daily, 2010). Previous literature also has suggested that companies report environmental information to establish legitimacy (Deegan, 2002) with the literature supporting manipulation strategy in regard to environmental reporting to establish legitimacy. Following these lines of argument, it is expected that Chinese companies will engage in similar reporting strategies in regard to greenhouse gas reporting to establish legitimacy.

4. Greenhouse gas reporting regulation in China

In its commitment to reduce greenhouse gas emissions, China introduced its 11th five-year plan for the periods 2006-2010. The aim of this plan was to reduce energy consumption by 20 percent per unit of GDP and 10 percent of pollutant based on 2005 (Wen, 2005). This was followed by the introduction of a national climate change program. This program commenced in June 2007. The program promotes environmental protection including the development of technology to reduce energy consumption and reduce carbon dioxide emissions (National Development and Reform Commission, 2007). This was followed by the 12th five-year plan, for the period 2011-2015.

There are several laws in China promoting environmental protection including:

"Environmental Protection Law", which was enacted in 1989, only outlines the responsibilities of the department of environmental protection administration and local governments in regard to environmental protection (National People's Congress, 2011).

"Energy Conservation Law", which came into effect in 1998, aimed to promote energy conservation by encouraging organizations to use energy efficiently so as to protect the environment. The "Energy Conservation Law" requires organizations to take responsibility for energy conservation by implementing technical measures such as advanced technologies and the provision of training to employees (National People's Congress, 2011).

The "Chinese Provisional Regulations on Energy Conservation and Emission Reduction for Central State-Owned Enterprises" is a regulation that only applies to central state-owned enterprises. This regulation came into effect from 2010 and classifies these enterprises based on their energy consumption and specifies management systems to reduce such consumption depending on their level of energy use (State-owned Assets Supervision and Administration Commission of the State Council, 2010).

A further law advancing environmental protection is the "Circular Economy Promotion Law," which was enacted in 2008 and came into effect in 2009. Its purpose is to increase resource utilization rate, protect and improve environment and achieve sustainable development.

The "Circular Economy Protection Law" requires enterprises to take steps to protect the environment such as the implementation of management systems and measures to reduce the discharge of waste (The Standing Committee of the National People's Congress, 2008).

Yet another environmental law is the "Cleaner Production Promotion Law," which was passed in 2002 and came into effect from 2003. The purpose of the "Cleaner Production

Promotion Law” was to promote cleaner production, increase the efficiency of utilization of resources, reduce and avoid pollutants, protect and improve the environment and promote sustainable development. Measures for the disclosure of environmental information were formulated in 2008 to mandate reporting of pollutant status by heavily polluting enterprises. Local governments may announce a list of heavily polluting enterprises from time-to-time. Enterprises appearing in this list are required to disclose the status of their pollutant discharges, facilities of environmental protection in the local media and report to the local government within 30 days of the pollutant list being published (Ministry of Environmental Protection of the People’s Republic of China, 2007).

It should be emphasised that not one law in China mandates the reporting of greenhouse gas information in annual reports. Hence it is voluntary for Chinese companies to report such information.

5. Hypotheses development

Hypotheses were developed using legitimacy theory. This is explained as follows.

5.1 Industry sectors

Previous studies focussing on developed economies reported a relationship between industry and the extent of environmental reporting (Brammer and Pavelin, 2008; Hackston and Milne, 1996; Halme and Huse, 1997; Gray et al., 2001). Prado-Lorenzo et al. (2009) and Choi et al. (2010) reported a relationship between an industry sector and greenhouse gas reporting. Companies operating in an industry with a higher level of greenhouse gas emission are more sensitive to climate related issues, as the public expect them to engage in the reduction of greenhouse gas emissions. If these companies do not fulfil social expectations, a legitimacy gap develops (Wilmshurst and Frost, 2000). As companies operating in an industry with a higher level of greenhouse gas emissions are more publicly visible compared to those operating in lower emission industries, they tend to disclose more information to legitimise their action (Arvidsson, 2010). Hence, the following hypothesis is developed:

H1. Companies operating in an industry sector with high levels of greenhouse gas emissions will report more greenhouse gas information than companies operating in an industry sector with low levels of greenhouse gas emissions.

5.2 Size

Larger companies are more visible and more sensitive to political pressure than smaller ones (Watts and Zimmerman, 1978), as they are more likely to be visible to the government, environmental groups, the media and social groups (Zhou, 2009). Corporate social reporting (CSR) is a strategy adopted by companies to achieve legitimacy and survive in society. Legitimacy theory suggests that visible companies which face higher public pressure need to be involved in socially responsible activities and tend to report more information to the public (Arvidsson, 2010) to maintain legitimacy (Ghazali, 2007) and protect their reputation (Hooghiemstra, 2000). There are several studies investigating the relationship between the size of companies and the extent of CSR. Past literature has reported a significant relationship between company size and CSR (Cormier et al., 2005; Feng, 2009; Ghazali, 2007; Zhou, 2009). Existing literature also reported a significant relationship between company size and greenhouse gas reporting (Freedman and Jaggi, 2011; Prado-Lorenzo et

al., 2009; Stanny and Ely, 2008). Based on this past literature, it is expected that there will be a relation between company size and greenhouse gas reporting by Chinese companies. Hence the following hypothesis is developed:

H2. There is positive relationship between company size and the extent of greenhouse gas reporting.

5.3 Profitability

Previous literature has reported a relationship between profitability and CSR. Companies with higher profit are more visible. Bo (2009) reported a positive relationship between profitability and CSR by examining annual reports of 426 Chinese companies listed in the Shenzhen Stock Exchange. It is suggested that financial performance is the internal factor influencing CSR disclosure (Bo, 2009), as companies report corporate social information to maintain a good reputation and social acceptance (Mo, 2008). However, existing studies reported mixed results in regard to the relationship of profitability and voluntary disclosure. There are studies that have suggested a positive relationship between profitability and the extent of voluntary disclosure (Choi et al., 2010; Gray et al., 2001). On the other hand, some studies reported no relationship between profitability and CSR (Brammer and Pavelin, 2008; Mukherjee et al., 2010). Legitimacy theory suggests that higher visibility leads to higher public pressure (Cormier and Gordon, 2001). Consistent with legitimacy theory expectations, it is expected that companies with higher profit will report a higher amount of greenhouse gas information, as the public expect companies to take more responsibility to reduce their greenhouse gas emissions. As a result, these companies would be expected to have a higher level of disclosure:

H3. There is positive relationship between profitability and greenhouse gas reporting.

5.4 Overseas listing

Rapid growth in China and its move towards internationalisation attracts considerable foreign investment to the country. Hence, many companies on the Chinese stock exchange are also listed on stock exchanges outside mainland China, such as Hong Kong and overseas, such as in the USA (Tang and Li, 2009). Companies listed on overseas stock exchanges need to meet the expectations of those countries (Tang and Li, 2009). Multinational companies face higher pressure from the domestic and global community (Tang and Li, 2009) than the domestic ones. Multinational Chinese companies have a social contract not only with China but also with foreign countries they operate in Newson and Deegan (2002). Hackston and Milne (1996) provided tentative support that companies listed on overseas stock exchanges may disclose more information. Among the various issues outlined in CSR, greenhouse gas emission is an issue which has attracted global attention. Hence it is timely to investigate voluntary disclosure made by multinational Chinese companies (Kolk et al., 2010). Following previous literature and legitimacy theory expectations, it is expected that Chinese multinational companies will report a higher amount of greenhouse gas information compared to those companies only listed on the Chinese stock exchange. Hence, the following hypothesis is developed:

H4. Chinese companies listed in Chinese and foreign stock exchanges report higher amount of greenhouse gas information than companies listed only in China.

5.5 State ownership

Some Chinese companies are owned by the state, or have a majority ownership by the state. Kolk et al. (2010) have suggested future research to compare the extent of CSR disclosure between state-owned companies and private companies. Similar to China, government ownership is a feature in the Malaysian corporate sector (Ghazali, 2007). Ghazali (2007) investigated the relationship between state ownership and CSR by examining annual reports of 87 non-financial companies on the Bursa Malaysia Composite Index. Their study reported that state ownership was significantly related to CSR, as state companies are expected to have a higher commitment to fulfil social and political agendas compared to private ones. Hence these companies are required to be involved in socially responsible activities. Government owned companies face higher levels of public pressure and expectation. Following such public expectations to achieve legitimacy, these companies report a high amount of corporate social information. However, Feng (2009) did not find a significant relationship between ownership concentration and CSR of Chinese companies. Feng (2009) suggested that state-owned Chinese companies should engage more social activities and report more corporate social information than private-owned companies. Recent news media in China report that state-owned Chinese companies seem to have increased their CSR, as the Chinese Government has committed itself to reduce its CO₂ emissions (The People's Daily, 2010). State-owned companies are now under high pressure to reduce their greenhouse gas emissions. Hence, following the tenets of legitimacy theory it is expected that state-owned companies will report more greenhouse gas information compared to private companies. This is expressed in the form of the following hypothesis:

H5. State-owned Chinese companies report more greenhouse gas information than private companies.

6. Research method

6.1 Sample

The sample used in this study includes annual reports of the top 100 A-share issuing companies on the Shanghai Stock Exchange, based on market capitalization. There are two stock exchanges in mainland China: the Shanghai Stock Exchange and the Shenzhen Stock Exchange. The Shanghai Stock Exchange is the most important stock exchange in China. Shanghai is known as the economic hub of China (Ma, 2004). Most of the companies in Shanghai are state-owned companies and large companies belonging to diverse industry groups (Ma, 2004; Shanghai Stock Exchange, 2011). The number of listed companies, the total market capitalization and the total negotiable market value of companies listed on the Shanghai Stock Exchange (2011), are higher than those companies listed on the Shenzhen Stock Exchange. The total market capitalization of Shanghai Stock Exchange is 26.98 trillion RMB (Shanghai Stock Exchange, 2012) compared to RMB 6.6 trillion of the Shenzhen Stock Exchange as on December 30, 2011 (Shenzhen Stock Exchange, 2012). In this study, only companies listed on the Shanghai Stock Exchange are included in the sample selection as this is the most important stock exchange in China (Ma, 2004, p. 12). Chinese companies can issue A-shares and B-shares. A-shares are traded among Chinese

residents with domestic currency (RMB) while B-shares are traded with foreign currency (USD in the Shanghai Stock Exchange) (Lu et al., 2011). The Shanghai Stock Exchange became absolutely dominated by A-shares by the end of 2010 (Shanghai Stock Exchange, 2010). Hence, companies listed on A-share market are included in the sample. The use of “market capitalization” as a representation of firm size has been extensively used in previous literature (Cowan and Gadenne, 2005; Debreceeny et al., 2002; Tilt and Symes, 1999).

6.2 Measurement of variables

6.2.1 Independent variables. “0” was assigned to companies belonging to an industry sector with a low level of emissions and “1” was assigned to companies belonging to a sector with a high level of emissions. The list of high-emitting industries listed by the Chinese Academy of Sciences was taken as the guide in this regard (cited in Zhang, 2010). Industries which are considered “high emission” are electricity, heat supply and production, petroleum industry, nuclear fuel exploration and processing industry, ferrous metal processing industry, non-metallic mineral manufacturing industry, chemical manufacturing industry, coal mining industry, transport and the postal industry.

Consistent with the previous literature (Hackston and Milne, 1996; Hossain et al., 2006; Smith et al., 2007), “total assets” is used as the proxy for “size”. The natural logarithm of “total assets” is used to reduce the skewness of the data. Also consistent with the previous literature (Choi et al., 2010; Prado-Lorenzo et al., 2009; Smith et al., 2007; Stanwick and Stanwick, 2004) “ROA” is used as the proxy for “profitability.” The natural logarithm of ROA is used to reduce the skewness of the data.

Companies listed only in China were assigned “0.” Companies listed outside mainland China were assigned “1.” Companies listed outside mainland China are listed on stock exchanges such as Hong Kong, New York and London. “0” was assigned to companies with only private ownership. “1” was assigned to those companies that were state owned. China Securities Index Company (CSI) State-owned Enterprises Composite Index (CSI SOEs) was used to determine whether a company was “state owned.”

6.2.2 Dependent variables. The extent of corporate greenhouse gas reporting was measured by content analysis of annual reports and CSR reports or equivalent. “Content analysis” is a set of procedures for gathering and organizing information in a standardized format (US GAO, 1982). Content analysis answers the “what” question (US GAO, 1982, p. 1). The present paper requires the determination of greenhouse gas information reported by Chinese companies; hence, “content analysis” is appropriate for this study.

6.3 Content analysis

As stated above, the present paper conducts “content analysis” of annual reports of Chinese companies to determine their level of greenhouse gas reporting. Content analysis requires the selection of “recording unit.” There are three choices of recording unit. They are “words” (Deegan and Gordon, 1996), “sentences” (Tsang, 1998) and “proportion of a page” (Gray et al., 1995).

Measurement based on “words” is problematic, as “words” are meaningless without sentences (Milne and Adler, 1999). “Number of pages” as a recording unit is inappropriate, as a page may contain other information together with greenhouse gas related ones. The number of pages is also dependent on font size, margins, graphics (Mitchell et al., 2006).

Hence, “number of sentences” is chosen as the recording unit as it involves less subjective judgement compared to other measures (Deegan et al., 2002).

A sentence is provided a score of “1.” If a sentence contained information belonging to two categories in the disclosure index, the sentence is double counted. Graphical diagrams, table, pictures and captions for pictures of activities are taken out as their inclusion lead to level of subjectivity (Ahmed and Sulaiman, 2004).

The disclosure index is developed following Choi et al. (2010), who developed a checklist following the questionnaire from the CDP to investigate the practice of voluntary carbon reporting in Australia. CDP is an independent not-for profit organization that aims to reduce greenhouse gas emissions and water use. Its headquarters are located in the UK with a presence in the USA, Europe, India, China, Japan, Germany, the Nordic region, Ireland, South America, Australia and New Zealand. CDP invites organizations to report about carbon emissions in its required format (www.cdpproject.net accessed February 22, 2012). Choi et al. (2010) applied the checklist to measure the level of carbon emissions disclosure by Australian companies. The present study measures the level of greenhouse gas reporting by Chinese companies. Hence the checklist developed by Choi et al. (2010) is appropriate for the present study.

Choi et al. (2010) categorised carbon emissions in terms of topics such as “climate change: risks and opportunities,” “greenhouse gas emissions accounting,” “energy consumption accounting,” “greenhouse gas reduction and cost” and “carbon emissions accountability.” Their checklist is modified following Chatterjee and Mir (2008), who developed categories following previous literature to categorise environmental reporting of Indian companies. Their study included categorization of environmental reporting based on the type of news and location of reporting. The “other” sub-category was included under each category of classification to capture information that was unable to be classified under other sub-categories. For example, “other information related to climate change” was added to capture other information reported in regard to “climate change: risks and opportunities” that could not be categorised into the first three groups. The Greenhouse Gas Reporting Index (GGRI) of the present study is outlined in the Appendix.

6.4 Regression model

Following the aim of this study being to investigate the factors determining the extent of greenhouse gas reporting by Chinese companies and its underlying hypotheses, the following regression equation is developed:

$$GGR = \alpha + \beta_1 IND + \beta_2 SIZE + \beta_3 PROFIT + \beta_4 OVERSEA LISTING + \beta_5 STATE OWNERSHIP + \varepsilon$$

GGR = the number of sentences on greenhouse gas disclosed by Chinese companies.

IND = industry dummy variables of 1 if the firms is in the list of high-emitting industries, otherwise 0.

SIZE = logarithm of total assets.

PROFIT = logarithm of ROA (net income divided by total assets).

OVERSEAS LISTING = a dummy variable of 1 if firms are listed in Shanghai Stock Exchange and outside mainland China, otherwise, 0.

STATE OWNERSHIP = a dummy variable of 1 if firms are state-owned companies, 0 if firms are private-owned companies.

ε = the estimate error.

Backward regression was performed. In a backward elimination procedure, the poorest predictor is removed from the model. The elimination procedure stops when p-value of all predictors in the model is less than 0.05 (Norusis, 2010).

7. Results

7.1 Descriptive statistics

Descriptive statistics in Table I reports that of the 100 companies, 92 (92 percent) reported at least one component of the GGRI. The number of non-reporting companies is only 8 percent. This indicates awareness of Chinese companies in respect of greenhouse gas emissions.

Of the eight companies that did not report any greenhouse gas information, four belong to the food and medicine manufacturing and wholesale industry. The food industry generally emits low levels of greenhouse gas emissions. Hence, it is not expected that there will be public pressure on these companies to report greenhouse gas emission information.

Table II reports that of the 100 companies, most (61 percent) reported between one and 20 sentences. This is consistent with the finding in CDP (2011) that reported the laggard nature of Chinese companies to respond to carbon related information. In CDP (2011), only 11 percent of sample Chinese companies responded to the survey, which is the second smallest response rate worldwide (Pricewaterhousecooper, 2010).

Only one company, the China COSCO Holding Company Limited, reported the largest number of sentences (84). China COSCO Holdings Company is operating in the transport and postal industry, which is considered high emissions industry. Hence, the company is under high pressure to report greenhouse gas information.

Table I. Status of greenhouse gas reporting by companies.

Particulars	Number	Percent
Companies disclosing at least one greenhouse gas information	92	92
Non-disclosing companies	8	8
Total	100	100

The negative impact of climate change resulting from greenhouse gas emissions has attracted the attention of the company. The company mentioned in its 2010 CSR report typhoons per year which can actually reduce considerable economic benefits to the China COSCO Holding Company (Sustainability Development Report, COSCO Holding Company, 2010). Therefore, it is expected that the China COSCO Holding Company will be more willing to commit itself to reduce greenhouse gas emissions.

The company is also a member of Global Compact. This membership helps the company to develop its business globally and it is also required to take more environmental responsibility (Sustainability Development Report, COSCO Holding Company, 2010). In 2008, the company supported the “caring for climate” statement of the United Nations (SASAC, 2008) and in 2009, the company agreed with the “Qingdao Declaration” to reduce

greenhouse gas emissions and energy consumption (Sustainability Development Report, COSCO Holding Company, 2010). Through joining the Global Compact and the “Caring for Climate” statement, and agreeing to the “Qingdao Declaration”, China COSCO Holding Company committed itself to reduce greenhouse gas emission resulting in high level of greenhouse gas reporting in its sustainability report.

Table II. Greenhouse gas reporting in annual reports and CSR reports

Number of sentences disclosed	Number of companies
1-20	61
21-40	25
41-60	5
61-80	0
81-100	1
Total	92

Table III provides descriptive characteristics of the independent variables used in the study. A majority of companies (69 out of 100) fall into the category of industries with a relatively low level of CO₂ emissions. Most sampled companies are listed only in China (63 out of 100), and 84 companies from the sample are state owned.

Table III. Descriptive characteristics of independent variables

	<i>n</i>
<i>Industry sector</i>	
High level of CO ₂ emission	31
Low level of CO ₂ emission	69
<i>Overseas listing</i>	
Yes	37
No	63
<i>State ownership</i>	
Stated owned companies	84
Private owned companies	16
Note: <i>n</i> = 100	

Table IV reports the “size” and “profitability” of sample companies. “Total asset” and “ROA” are used to represent the “size” and “profitability” of companies, respectively.

Table VI. Descriptive characteristics of independent variables

	<i>n</i>	Minimum	Maximum	Mean	SD
Total assets	100	3.46 billion	13,500 billion	752.88 billion	2,263.87 billion
Lgtotalassets	100	9.54	13.13	10.9546	0.83386
ROA	100	0.0036	0.2087	0.062349	0.0486337
LgROA	100	−2.45	−0.68	−1.3718	0.42448
GGR	100	0	84	15.79	15.495

As the sample of Chinese companies was chosen based on their market capitalization, the “size” and “profitability” of selected companies is not normally distributed. Hence, the logarithm of total assets is used as a measurement of size of sampled companies to

overcome the bias. The logarithm of total assets of the largest companies is 13.13, while the minimum of logarithm of total assets is 9.54. The mean of “size” is 10.95, while the standard deviation is 0.834. Similarly the “size” is transformed into normality by taking the logarithm of ROA. The logarithm of ROA is -1.37 and the standard deviation is 0.42. The highest LogROA is -0.68 while the lowest is -2.45.

The dependent variable (GGR) is the extent of greenhouse gas reporting. The total number of sentences reported is 1,581. The average number of sentences reported by reporting companies is 17.18. The maximum number of sentences is 84.

Table V reports the disclosure of GRI information by five categories. As shown in the last column, the highest number of disclosed sentences as a percentage of all disclosed sentences is 65.72 percent found under the category “energy consumption accounting” (BBC3), while the smallest percentage of sentences (0.57 percent) was disclosed under the category “carbon emission accountability” (BBC5). The largest number of disclosed sentences was reported under the category “energy consumption accounting” (BBC 3) that is 1,039.

Consistent with the result reported by Chatterjee and Mir (2008), the greatest number of sentences was reported under the heading “other information on energy consumption accounting,” followed by “other information on GHG accounting (for example, awards),” and “other information related to climate change.” “Other information” under each of the categories includes material that cannot be classified under any other sub-category. These sentences are narrative rather than providing facts about the company. An example of “other information on energy consumption accounting” is “Adhering to the idea of sustainable development, ABC takes energy saving and environmental protection as its compulsory duty” (Corporate Social Responsibility Report, Agricultural Bank of China, 2010, p. 20). An example of “other information on GHG accounting” is “ICBC has been awarded as the ‘Best Green Bank for Innovation,’ the ‘Low-Carbon Trendsetting Bank’ and the ‘China Low-Carbon Pioneer Bank’” (Corporate Social Responsibility Report, ICBC, 2010, p. 2). An example of “other information related to climate change” is “Climate change is a major global issue that has attracted the attention of the international community” (Sustainability Report, Petrol China Company, 2010, p. 27). No disclosures were made in regard to “GHG emissions by sources (GHG4)” and “energy used by facility or segment level” (EC4).

Table V reports that most of the information reported by companies contains good and neutral news. Only one company reported bad news. “Good news” includes statements which report a positive impact of the company on the environment. For example, Air China reported “decreased carbon dioxide emission per RTK to 0.8774 kg compared to 2009” statements which report a negative impact of the company on the environment. For example, China Southern Airlines reported an increase in energy consumption and greenhouse gas emissions due to the expansion of flights (Annual Report, China Southern Airlines, 2010). Statements that do not either report “good news” or “bad news” were categorised as “neutral news.”

Most companies (65 percent) reported greenhouse gas information not only in annual reports but also CSR reports (Table V). There are 1,380 sentences disclosed in both reports. Of the 92 reporting companies, 17 companies (18 percent of total) had greenhouse gas and related disclosures in annual reports only while 15 companies (16 percent of total) had that disclosure in CSR reports only.

Table V. Characteristics of greenhouse gas information reported

Broad components categories	Individual components	Disclosing companies	Disclosing companies as a percentage of total reporting companies (%)	Number of disclosed sentences	Number of disclosed sentences as a percentage of all disclosed sentences (%)
(BBC1) Climate change: risk and opportunity	(CC1) Assessment or description of the risks and/or actions taken or to be taken to manage the risks of climate change	7	7.61	18	1.14
	(CC2) Assessment or description of current (and future) financial implications	2	2.17	4	0.25
	(CC3) Assessment or description of current (and future) opportunities resulting from climate change for the business	5	5.43	10	0.63
	(CC4) Other information related to climate change	18	19.57	35	2.21
	Total			67	4.24
(BBC2) Greenhouse gas (GHG) emissions accounting	(GHG1) Description of the methodology used to calculate GHG emissions	1	1.09	3	0.19
	(GHG2) Existence external verification of quantity of GHG emission (by whom and on what basis)	3	3.26	3	0.19
	(GHG3) Total GHG emissions	2	2.17	3	0.19
	(GHG4) Disclosure of GHG emissions by sources (e.g. coal, electricity, etc.)	0	0.00	0	0.00
	(GHG5) Disclosure of GHG emissions by facility or segment level	2	2.17	2	0.13
	(GHG6) Comparison of GHG emissions with previous years	2	2.17	2	0.13
	(GHG7) Other information on GHG accounting (for example, awards)	51	55.43	130	8.22
	Total			143	9.04
	(EC1) Total energy consumed	12	13.04	13	0.82
	(EC2) Quantification of energy used from renewable sources	10	10.87	14	0.89
(BBC3) Energy consumption accounting	(EC3) Disclosure of energy use by types (e.g. coal, electricity, etc.)	24	26.09	71	4.49
	(EC4) Disclosure of energy use by facility, or segment level	0	0.00	0	0.00
	(EC5) Comparison of energy consumption with previous year or reduction target level	57	61.96	125	7.91
	(EC6) Other information on energy consumption accounting	91	98.91	816	51.61
	Total			1,039	65.72
					(continued)

Broad components categories	Individual components	Disclosing companies	Disclosing companies as a percentage of total reporting companies (%)	Number of disclosed sentences	Number of disclosed sentences as a percentage of all disclosed sentences (%)
(BBC4) GHG reduction and cost	(RC1) Detail of plans or strategies to reduce GHG emissions	50	54.35	247	15.62
	(RC2) Specification of GHG emissions reduction target level and target year	13	14.13	16	1.01
	(RC3) Emissions reductions and associated costs or savings achieved to date as a result of the reduction plan	22	23.91	49	3.10
	(RC4) Cost of future emissions factored into capital expenditure planning	0	0.00	0	0.00
	(RC5) Other information on GHG reduction and cost	11	11.96	11	0.70
(BBC5) Carbon emission accountability	Total			323	20.43
	(ACC1) Indication of which board committee (or other executive body) has overall responsibility for actions related to climate change	6	6.52	8	0.51
	(ACC2) Description of the mechanism by which the board (or other executive body) reviews the company's progress regarding climate change	1	1.09	1	0.06
News type	Total			9	0.57
	Neutral new only	23	25.00	119	7.53
	Bad and neutral	1	1.09	11	0.70
	Good and neutral	57	61.96	1,036	65.53
	Good, bad and neutral	11	11.96	415	26.25
Medium of reporting	Total	92	1	1,581	1
	Annual report only	17	18.48	68	4.30
	CSR report only	15	16.30	133	8.41
	Both annual report and CSR report	60	65.22	1,380	87.29
	Total	92	1	1,581	1

7.2 Inferential statistics

A correlation matrix is shown in Table VI, prior to the interpretation of the results of the regression. The table reports that not all the independent variables are statistically related to each other. The highest inter-correlation between independent and dependent variables is - 0.670 between log of ROA and log of total assets. This is less than 0.85 (Allen and

Bennett, 2010). Hence, there is no significant inter-correlation between independent variables in the correlation matrix.

Table VI. Correlation matrix

	Industry	Overseas listing	Stated ownership	Log total assets	Log ROA	GGR
Industry	1					
Overseas listing	0.203*	1				
State ownership	0.175	0.221*	1			
Size	-0.096	0.503**	0.058	1		
Profitability	0.284**	-0.183	-0.030	-0.670**	1	
GGR	0.186	0.303**	-0.091	0.455**	-0.220*	1

Note: *Moderately significant

Table VII reports the result of regression following the backward elimination approach to test hypotheses. Backward regression is used to find an equation that best predicts the dependent variable as a linear function of the independent variables. As shown in model 1 of Table VII, backward regression began with an examination of the combined effect of all the independent variables (industry, size, profitability, overseas listing and state ownership) on the dependent variable. One by one, starting with the weakest predictor, independent variables were removed, and a new analysis was performed. Thus, for model 2 of Table VII, profitability was removed and the results of this regression showed state ownership as the weakest predictor. This predictor was then eliminated for the new analysis for model 3. After these backward eliminations, results of these regressions are presented in model 3 of Table VII.

Table VII. Multiple regression

Model		Unstandardized coefficients		Standardized coefficients β	<i>t</i>	Sig.	Adjusted R^2
		B	SE				
1	(Constant)	-79.085	24.187		-3.270	0.002	0.252
	Industry sector	7.963	3.170	0.239	2.512	0.014 ^a	
	Overseas listing	1.714	3.472	0.054	0.493	0.623	
	Stated ownership	-7.207	3.797	-0.171	-1.898	0.061	
	Size	9.145	2.559	0.492	3.574	0.001 ^b	
	Profitability	1.715	4.556	0.047	0.376	0.707	
2	(Constant)	-74.568	20.906		-3.567	0.001	0.259
	Industry sector	8.264	3.054	0.248	2.706	0.008 ^b	
	Overseas listing	1.949	3.400	0.061	0.573	0.568	
	Stated ownership	-7.318	3.769	-0.174	-1.942	0.055 ^c	
	Size	8.510	1.915	0.458	4.443	0.000 ^b	
3	(Constant)	-80.733	17.865		-4.519	0.000	0.264
	Industry sector	8.723	2.937	0.262	2.971	0.004 ^b	
	State ownership	-6.927	3.694	-0.165	-1.876	0.064 ^c	
	Size	9.096	1.614	0.489	5.634	0.000 ^b	

Notes: ^aSignificant, ^bhighly significant and ^cmoderately significant; dependent variable: GGR

Following backward regression, Table VII reports significant positive relationship between “industry sector” and “greenhouse gas reporting” (p-value 0.004). Analysis of greenhouse gas reporting by companies reveals that the mean number of sentences reported by companies in industries with high levels of carbon emission is 20, which is greater than the

mean number of sentences reported by the total number of companies: that is, 16 sentences. On the contrary, the mean number of sentences reported by companies with lower level of carbon emission is 14, which is slightly lower than the mean number of sentences reported by the total number of companies.

Table VII reports that “size” is related to greenhouse gas reporting. Larger companies reported more greenhouse gas information than smaller ones (p-value 0.000). This is due to higher visibility of larger companies to the public compared to smaller ones. Analysts monitor larger companies more than smaller ones (Cormier et al., 2005). Legitimacy theory suggests that visible companies report more information to the public (Arvidsson, 2010) to maintain legitimacy (Ghazali, 2007).

Table VII also reveals that “profitability” (LogROA) is not a significant predictor of greenhouse gas reporting by Chinese companies (p-value is 0.707 in the first equation). The table reports that the p-value of testing of relationship between dual listing and the level of greenhouse gas disclosure is greater than 0.05 (0.623 and 0.568 in the first and second equation, respectively). Hence, there is no significant relationship between “overseas listing” and “greenhouse gas reporting”.

Further, Table VII shows that the relationship between “state ownership” and “greenhouse gas reporting” is negative ($\beta = -0.165$). Contrary to the hypothesis, private companies reported more greenhouse gas information compared to state-owned ones. However, it is not significant in the third equation reported in Table VII as the p-value is 0.064. Private-companies reported more greenhouse gas information compared to state-owned companies as the mean number of sentences reported by these companies is 19, compared to 15 sentences reported by state-owned companies.

Table VIII reports greenhouse gas disclosure by high emissions industries. On average, industry wise analysis reports that the highest average number of sentences was reported by companies in the “ferrous metal processing industry” followed by companies in the “transport and postal industry.”

Table VIII. Greenhouse gas disclosure by high emissions industries

Industries	Number of sample companies	Number of sentences disclosed	Average number of sentences disclosed
Electricity and heat supply and production industry	4	80	20
Petroleum and nuclear fuel exploration and processing industry	5	96	19.2
Ferrous metal processing industry	2	67	33.5
Non-metallic mineral manufacturing industry	1	11	11
Chemical manufacturing industry	3	30	10
Coal mining industry	8	118	14.75
Transport and postal industry	8	220	27.5
Total	31	622	20.06

8. Conclusion

This study investigated the factors driving greenhouse gas reporting in an emerging economy with a high level of greenhouse gas emission, namely, China. The study reports

that although not mandatory, most Chinese companies report some greenhouse gas information. This is consistent with legitimacy theory expectations, as recently the Chinese Government has introduced policies and programs to reduce greenhouse gas emissions.

The greatest number of reported sentences is found in the sub-category of “other information” under the category “energy consumption accounting”. This further supports legitimacy theory. This sub-category of information includes sentences that are narrative in nature rather than reporting factual data. Most information reported by companies is “neutral” and/or “good news.” Both of these findings support the legitimacy theory expectation that companies use their annual report as a tool to legitimise their action. One common legitimacy technique is “manipulation”, which refers to diverting the attention of the public.

Consistent with legitimacy theory expectations, the study indicates that there is a relationship between “industry sector,” “size” and “greenhouse gas reporting.” Larger companies reported more greenhouse gas information than smaller ones. Companies belonging to the “high carbon emission” industries reported more greenhouse gas information. According to Hackston and Milne (1996), large companies belonging to an industry with higher levels of carbon emissions report more greenhouse gas information than smaller ones belonging to industries with lower levels of emissions, in order to mitigate the risk and pressure the industry faces.

Contrary to the expectation of legitimacy theory, the present study reports that “profitability” and “overseas listing” are not significant predictors of greenhouse gas reporting. The reason behind this finding in the present study may be due to the relatively low standard deviation of 4.86 percent between the firms in the sample. The insignificant relationship reported in the present study between “profitability” and “greenhouse gas reporting” is consistent with the findings in previous studies in the area of CSR (Tilling and Tilt, 2010) and environmental reporting (Brammer and Pavelin, 2006; Mukherjee et al., 2010; Stanny and Ely, 2008).

The finding that “overseas listing” is not significantly related to “greenhouse gas reporting” in the present study is contrary to the expectation of Hackston and Milne (1996). China is in the early stages of trying to balance economic and sustainability interests, which may partly explain the non-relationship. Considering the newness of China’s greenhouse gas regulations, it may take time for companies with overseas operations to synthesize China’s regulations and engage in legitimising tactics.

Finally, contrary to the expectation of legitimacy theory, the study reports a negative relationship between “state ownership” and “greenhouse gas reporting.” “State-owned” companies reported less information on greenhouse gas. A possible reason behind this unexpected result is that since the assets of state-owned companies belong to the government, these companies do not make significant decisions themselves (Cao et al., 2007), such as large investments on greenhouse gas or energy reduction. Another alternative explanation as suggested by Zhou (2009) is that in state-owned companies the government controls the management of these entities. There is relatively little power enjoyed by private shareholders in these companies. Hence, management may be less motivated to report greenhouse gas information as not reporting such information saves cost. Another possible explanation is that state-owned companies do not need to gain legitimacy as they are protected by the government (Tang and Li, 2009).

Contrary to the expectations of legitimacy theory, this study found that “profitability” and “overseas listing” are not significant predictors of greenhouse gas reporting. This has implications for the adaptation of this theory in emerging economies and in the context of greenhouse gas reporting, and can therefore be seen as one of this study’s contributions towards theoretical development, by testing legitimacy theory in the context of greenhouse gas reporting by companies in an emerging economy, China. Most of the existing studies have concentrated on developed economies.

Furthermore, the study contributes towards the future development of greenhouse gas-related reporting standards by outlining the status and scarcity of this reporting by Chinese companies, indicating required improvements in this regard. One of the reasons behind such scarcity of reporting greenhouse gas information by Chinese companies may be the voluntary nature of such reporting. In order to increase the level of greenhouse gas reporting by Chinese companies it is necessary to develop a greenhouse gas-related reporting standard. Most of the information reported by these companies is narrative, stressing the commitment of these companies to reduce greenhouse gas emissions without any supporting evidence of achievements or even commitments. Reporting on current and future financial implications of climate change, total CHG emissions, disclosure of energy use by a facility or segment thereof, and the cost of future emissions factored into capital expenditure is sparse. Most of the information reported by the companies under study is “neutral” with some reporting “good news.” There is a dearth of “bad news.” While this may be due to the fact there is no “bad news,” it is also possible that companies do not like to report “bad news.” This dearth indicates that reporting standards need to emphasise the necessity of reporting of factual data and “bad news.”

9. Limitations and directions for future research

This study is limited to a sample size of the top 100 A-share issuing companies on the Shanghai Stock Exchange, based on market capitalization. It confines its investigation to 2010 annual reports and CSRs. Despite these limitations, the study uses relatively contemporary data of important A-share listed companies to uncover findings of greenhouse gas reporting. It should be noted that the present study tests the factors driving greenhouse gas reporting with the help of secondary data only. Further research might use primary data to discover richer evidence of the reasons for reporting or non-reporting of greenhouse gas information. The present study is limited to the investigation of the extent of greenhouse gas reporting in the main text of annual reports. It did not investigate the reporting of greenhouse gas reporting in diagrams, table, pictures and captions to pictures. It is suggested that further research perform longitudinal analysis of greenhouse gas reporting with a larger sample and conduct in-depth interviews of company executives of Chinese companies to further provide insights into factors that determine their greenhouse gas reporting. Comparison of greenhouse gas reporting to the Chinese audience compared to overseas audiences by those Chinese companies listed overseas, can also provide further insight into the motivation of these companies behind such disclosures. Future research could investigate greenhouse gas reporting in other media by Chinese companies such as newspapers and corporate web sites. Such research might investigate the extent of greenhouse gas reporting in diagrams, tables, pictures and captions in corporate annual reports. These potential investigations would further facilitate theoretical development in the context of corporate reporting in emerging economies and in the context of greenhouse gas reporting.

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Appendix

The greenhouse gas index is composed of seven broad based components (BBC). Each BBC contains sub-components as shown in Table AI.

Table AI. Greenhouse gas reporting index

		Source
<i>BBC1</i>	<i>Climate change: risks and opportunities</i>	
(CC1)	Assessment or description of the risks and/or actions taken or to be taken to manage the risks of climate change	Choi <i>et al.</i> (2010)
(CC2)	Assessment or description of current (and future) financial implications	Choi <i>et al.</i> (2010)
(CC3)	Assessment or description of current (and future) opportunities resulting from climate change for the business	Coi <i>et al.</i> (2010)
(CC4)	Other information related to climate change	New
<i>BBC2</i>	<i>Greenhouse gas (GHG) emissions accounting</i>	
(GHG1)	Description of the methodology used to calculate GHG emissions	Choi <i>et al.</i> (2010)
(GHG2)	Existence external verification of quantity of GHG emission (by whom and on what basis)	Choi <i>et al.</i> (2010)
(GHG3)	Total GHG emissions	Choi <i>et al.</i> (2010)
(GHG4)	Disclosure of GHG emissions by sources (e.g. coal, electricity, etc.)	Choi <i>et al.</i> (2010)
(GHG5)	Disclosure of GHG emissions by facility or segment level	Choi <i>et al.</i> (2010)
(GHG6)	Comparison of GHG emissions with previous years	Choi <i>et al.</i> (2010)
(GHG7)	Other information on GHG accounting (for example, awards)	New
<i>BBC3</i>	<i>Energy consumption accounting</i>	
(EC1)	Total energy consumed	Choi <i>et al.</i> (2010)
(EC2)	Quantification of energy used from renewable sources	Choi <i>et al.</i> (2010)
(EC3)	Disclosure of energy use by types (e.g. coal, electricity, etc.)	Choi <i>et al.</i> (2010)
(EC4)	Disclosure of energy use by facility, or segment level	Choi <i>et al.</i> (2010)
(EC5)	Comparison of energy consumption with previous year or reduction target level	New
(EC6)	Other information on energy consumption accounting	New
<i>BBC4</i>	<i>GHG reduction and cost</i>	
(RC1)	Detail of plans or strategies to reduce GHG emissions	Choi <i>et al.</i> (2010)
(RC2)	Specification of GHG emissions reduction target level and target year	Choi <i>et al.</i> (2010)
(RC3)	Emissions reductions and associated costs or savings achieved to date as a result of the reduction plan	Choi <i>et al.</i> (2010)
(RC4)	Cost of future emissions factored into capital expenditure planning	Choi <i>et al.</i> (2010)
(RC5)	Other information on GHG reduction and cost	
<i>BBC5</i>	<i>Carbon emission accountability</i>	
(ACC1)	Indication of which board committee (or other executive body) has overall responsibility for actions related to climate change	Choi <i>et al.</i> (2010)
(ACC2)	Description of the mechanism by which the board (or other executive body) reviews the company's progress regarding climate change	Choi <i>et al.</i> (2010)
<i>BBC6</i>	<i>News type</i>	
(NT1)	Good news	Chatterjee and Mir (2008)
(NT2)	Bad news	Chatterjee and Mir (2008)
(NT3)	Neutral	Chatterjee and Mir (2008)
<i>BBC7</i>	<i>Location</i>	
(L1)	Annual report	Chatterjee and Mir (2008)
(L2)	CSR report	(2008)

