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Research on the Correlation Between Carbon Performance and Carbon Disclosure in China

Ying Hou
Faculty of Business and Economics, Universiti Malaya, 50603 Kuala Lumpur, Federal Territory of Kuala Lumpur, Malaysia

Hanbo Zhu
School of Civil Engineering, Suqian College, 223800 Suqian City, Jiangsu Province, China

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Abstract

The majority of data and knowledge on the how Carbon Disclosure (CD) impacts a firm's real Carbon Performance (CP) has not increased in parallel with the amount of carbon disclosure. Therefore, this study applies the 'outside-in' management viewpoint to analyse the correlation between carbon performance and the carbon disclosure in china. The Carbon Disclosure Project (CDP) platform panel data study of china companies and their carbon declarations for the years 2017 to 2021 shows that increased CP in order to reduce greenhouse was associated with greater transparency around carbon expenditure. The link between CD and CP was shown to be very strong in studies of carbon-intensive enterprises. Additionally, the relationship of interest was minimal during the financial crisis; nevertheless, throughout the years, better carbon reporting was linked to fewer emissions. This research supports the idea that corporations are motivated to reduce their emissions as a result of being made aware of their carbon footprints. For business stakeholders and government authorities who are worried about the grade and effects of CD, our results are helpful.

Keywords

Carbon performance (CP), Carbon Disclosure (CD), Carbon Disclosure Project (CDP), climate change and China

Introduction

Greenhouse gas (GHG) emission reduction plans and general climate

change strategies are topics that companies are under increasing pressure to discuss. Due to the increased visibility of environmental issues, businesses are now under pressure to provide accurate information so that the dangers and possibilities they present may be carefully assessed. Environmental disclosure is increasingly a strategic issue for businesses and organisations [1]. Despite this, it is still unclear how disclosure of carbon emissions relates to actual emissions of GHG. Studies have looked into the potential that transparency can replace better emissions performance [2]. Other research have examined whether various performance types provide various environmental information. However, no researches have yet looked at the possibility that more transparency improves carbon performance through lowering emissions [3]. The current work seeks to solve this significant outstanding question [4]. This study tries to explain and present data on how transparency enhancements have improved carbon performance. The foundation of the "environmental impact charity the Carbon Disclosure Project" was significantly influenced by the need for stakeholders to have a better awareness of the dangers and possibilities posed by climate change (CDP) [5]. The CDP is a platform for corporations to report their environmental impacts, such as carbon emissions, in an attempt to increase disclosure and discourage funding for organizations that may be adversely affected by global warming. [6]. If successful, projects of this nature would aid in the transition to a low-carbon, more sustainable economy [7]. The study's goal is to increase the possibility that firms will disclose their carbon emissions. We offer a comprehensive model that incorporates the outside and inside effects of operations on carbon disclosure in addition to the strategic contribution of environmental acceptance and green innovation. According to the study's authors, a company's propensity to report its carbon footprint grows with the amount of environmental validity indicators it has, and the quantity of green innovation it employs. To kick off our revised approach to studying carbon disclosure in products, we examine the chain of causality from environmental acceptability to carbon disclosure, via green innovation. ISO14001 and "green patents" are examples of how this cutting-edge method is used to assess a company's commitment to environmental sustainability [8]. Researchers counted the number of patents filed in China for environmentally friendly products that included the phrases "low-carbon", "environmental", "green", "emissions reduction", "energy-saving", "clean", "cycling", "saving", "sustainable", "ecology", "environmental protection", and "environmental pollution". Fourth, the study's attention on the Chinese setting adds value to the ideas it explores since there are significant distinctions between established nations and emerging economies. Earlier research has been concentrated on more developed Western countries. Additionally, this study has significant guiding relevance for carbon disclosure and carbon performance in other emerging economies given that China, like other emerging economies, has rising environmental pollution but lacks strong standards or regulations.

Data and research design

Samples

The Carbon Disclosure Project (CDP) evaluates how businesses are handling GHG emissions reporting and other related matters. British institutional investors were the first to use it. China started the CDP study with 100 Chinese publicly traded enterprises. The CDP China 100's initial 500 observations between 2017 and 2021 were chosen for this study's sample because they are incredibly reliable, typical, ongoing, and simple to access.

Table 1: Methodology for Choosing Representative Samples

Panel A: Methodology for Choosing Representative Samples							
the first sample from 2017-2021							500
Remove firm-year data for which there is no yearly report available.							(3)
Remove firm-year data by using "Special Treatment (ST)"							(2)
Remove firm-year data with expired listings.							(6)
Remove firm-year data with given ages that are one year or less.							(2)
Remove firm-year observations that sell their stock to overseas investors							(30)
Use the cautious 3 standard deviation cutoff to exclude firm-year data with absolute values.							(37)
company-year assessments							420
Independent organization							179
Panel B: Proportion of each sample by year and industry							
	Years					Subtotal	%
	2017	2018	2019	2020	2021		
Leisure & Hospitality	2	1	2	1	3	9	1.90
Trade & Retail	1	1	4	2	2	10	3.33
Textile, Apparel & Luxury	2	3	2	2	2	11	2.38
Telecommunication & IT	2	5	6	2	5	20	3.57
Finance	9	14	13	19	23	78	19.29
Construction & Material	7	6	6	5	8	32	6.90
Real Estate	7	8	7	5	5	32	7.38
Auto Manufacture & Auto Components	5	4	5	5	4	23	4.29
Chemical (industry & fine) & Pharmacy	1	1	1	5	5	13	3.10
Transport & Transport Infrastructure	14	9	3	7	7	40	9.29
Machinery & Electric Appliance	8	7	7	7	2	31	7.62
Metals & Mining	11	11	9	9	6	46	11.90
Oil & Natural Gas	4	6	4	4	7	25	4.05
Power	7	9	6	3	4	29	6.19
others	4	0	7	5	5	21	3.81
Total by year	84	85	82	81	88	420	100

Table 1's Panel A provides information on the sample selection process. Due to their two years of continuous loss-making, we excluded three special treatment (ST) observations. In addition, we eliminated 36 data with immense importance to use the threshold of 3 standard deviations to be conservative, and 31 data for corporations that offered "B-shares and/or H-shares, whose financial features and regulatory settings are different". Only 420 findings from 179 distinct businesses remained after we eliminated 80 random observations. The data are displayed in Panel B of Table 1 by year and industry, demonstrating that there is no substantial difficulty with sector and year groupings. The RESSET database, yearly reports from all publicly traded corporations, and the Baiteng patent network were the main

sources of information for this study. The CDP reports were gathered, and the replies from focus firms were examined, in order to determine which businesses reveal their carbon emissions data. "Then, the 420 sampled observations were split into the response and no-response groups. Then, we did a content analysis of news stories from the public media". 32,060 reports in all were gathered and examined. Positive, negative, and neutral media coverage was the three possible tiers we set. Then, Janis-Fadner factors were developed to determine the credibility of environmental claims [9].

Measures

Carbon performance

Actual carbon emission intensity is the metric used to calculate carbon performance (CP) [10]. The usage of and scaling up of the CDP provided emission data depends on the sales turnover of each firm. Due to emissions' established importance in determining a company's carbon responsibility, it is acceptable to utilize this metric. By £'000 in sales revenue at year's end, the carbon emissions intensity is scaled. This is consistent with earlier research. Contrary to absolute emissions, these intensity metric accounts for fluctuations in product and service output, this facilitates comparisons between businesses over time.

Carbon disclosure

Future study that intends to employ survey techniques to gauge businesses' social environmental activities has been advocated as a worthwhile course of action. As a stand-in for a company's carbon disclosure, our analysis employs the CDP database's Carbon Disclosure Score (CDS). This CDS was obtained by a survey that was based on how a business responded to questions on the annual CDP questionnaire that was sent via the CDP's online response system. Based on an analysis of the replies, scores between 0 and 100 are assigned. By encouraging communication and information exchange between businesses, the CDP "is striving to mitigate the risks associated with transparency". Similar to financial disclosures, businesses should anticipate disclosing not just positive but also negative information on their emission volumes [11].

Controls

The size of the firm is a common independent variable in research on environmental disclosure. Larger, more well-known companies may face more political and regulatory pressure, which may increase their political expenses [12]. The natural log of total assets is used in the current study to account for firm size (SIZE). Additionally, businesses with strong cash flows are better positioned to engage in significant environmental initiatives, set aside money for compliance expenses, and enhance the environment. So, in order to manage liquidity, we

employ the current ratio (LIQ). Additionally, there is evidence that financial risk has a significant impact on how corporations decide to adapt their environmental strategy and make investments in the environment. By dividing the entire debt by the total assets, we arrive at the leverage ratio (LEV), which serves as a proxy for financial risk. Additionally, previous research discovered a substantial connection between company sustainability and financial performance. The financial performance (FP) impact is reflected in our return on assets. The effectiveness and capacity of a company's management have an impact on its desire and ability to invest in environmental challenges [13]. The likelihood that the company would proactively implement longer-term environmental investment initiatives is increased by having superior management capabilities. Sales growth has been used to gauge management effectiveness in creating financial value and improving the environment [14]. In the recent findings, sales expansion (S.GROW) is established by dividing sales shifts by base sales. There is evidence suggesting a causal relationship between board diversity and carbon disclosure. Therefore, a composite index is calculated using the elements of independent directors as dummy, sector-adjusted variables to remove the effect of independent directors on the performance of corporations. Previous studies have shown that growing organizations are more likely to have higher degrees of information asymmetry, which might prompt management to boost their amount of disclosures aimed at attracting new investors. We use the market-to-book ratio when adjusting for growth (GROW). Since October 1, 2017, the sampled companies have been required to abide by UK GHG reporting regulations, which include an obligation to publish their GHG emissions in the yearly Director's Report. A dummy variable (REG) is therefore added and is set to one for 2017 to 2021 and zero for all other years. Finally, by introducing yearly dummy variables, we account for the potential impact of shifting business trends that can alter the connection under study.

Methods based

To test the theory, our main empirical model is as follows:

$$CP_{it} = \beta_0 + \beta_1 CDS_{it} + \beta_2 SIZE_{it} + \beta_3 LIQ_{it} + \beta_4 LEV_{it} + \beta_5 FP_{it} + \beta_6 S.GROW_{it} + \beta_7 BC_{it} + \beta_8 GROW_{it} + \beta_{10} YEAR_{it} + \varepsilon_{it}$$

Where CDS stands for the carbon disclosure score and "CP stands for the proxy for carbon performance; LIQ is the current ratio, while SIZE is the natural log of all assets. LEV stands for the ratio of total debt to total capital; FP for return on assets; S. GROW is the market-to-book ratio, BC is the board composition index, and GROW is the sales growth". YEAR and REG are dummy variables with REG set to "1" for 2017 to 2021 and "0" otherwise. Panel data regression analyses the temporally shifting link between dependent and independent variables, adjusts for individual variability, minimizes multicollinearity, and estimation bias.

Results and analysis

Descriptive statistics

The descriptive statistics of the model variable are presented in figure 1 (A), (B) and (C). The properties of the mean and distribution are shown in Table 2, along with the values for each variable. Our CDP survey received responses from around 64% of our sample, and the mean CDS score for those who participated in the survey is 69.11. This finding is much greater than those that were reported in earlier research that used CDS as an independent variable. From Table 2, we can determine that the sample enterprises generate 4.839 tonnes of total emissions for every thousand pounds of sales revenue. 4.839 > 0.733 for the mean emission size indicates that the sample contains some of the largest emitters. As measured by the logarithm of total assets, the mean and median SIZE values were 21.

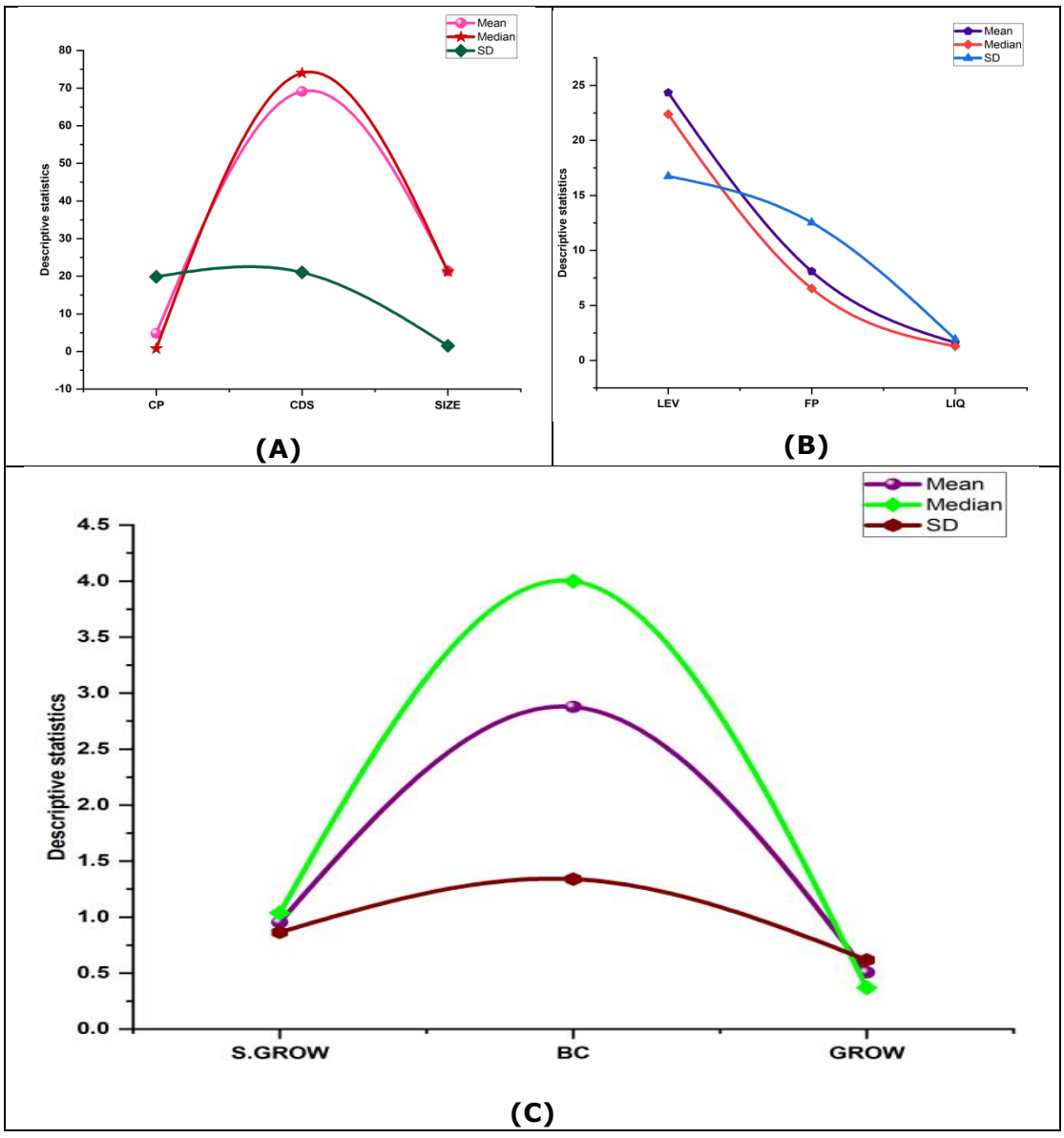

Figure 1: Descriptive statistics of model variables

Table 2: Properties of the mean and distribution of model variables

Variables	Mean	Median	Standard deviation	Minimum	Maximum
CP	4.842	0.736	19.868	0.008	431.65
CDS	69.118	74.002	21.019	7	104
SIZE	21.368	21.217	1.534	16.908	26.148
LEV	24.345	22.385	16.744	0.005	114.58
FP	8.095	6.534	12.526	-68.136	235.467
LIQ	1.618	1.288	1.918	0.216	61.978
S. GROW	0.955	1.038	0.865	0.006	26.528
BC	2.878	4.001	1.338	3	9
GROW	0.506	0.368	0.618	0.005	14.144

There is a correlation between CP and the other factors on the right, as seen in Table 3. (e.g. SIZE, BC, GROW and REG). "Large firms need to maintain their economic size in terms of product, sales, and staff, and so create larger GHG emissions," [15] states with reference to SIZE. Further, consistent economic expansion is associated with a sharp increase in total carbon emissions, as shown by a strong correlation between CP and GROW. More importantly, the negative correlation between CP and BC demonstrates that board composition has an impact on the investigated relationship, with higher-quality board composition leading to lower GHG emissions. The key result that carbon disclosure has a beneficial effect on the quantity of carbon emissions by reducing its level is supported by the considerable inverse connection between CP and CDS, which is in line with theoretical assumptions.

Table 3: The correlation analysis

Variables	CDS	SIZE	LEV	FP	S. GROW	GROW	REG	LIQ	CP	BC
CDS	1									
SIZE	-0.051*	1								
LEV	0.055**	0.368***	1							
FP	0.002	0.0012	0.153***	1						
S. GROW	-0.045	-0.096*	-0.238***	-0.135***	1					
GROW	0.035	-0.016	-0.126***	-0.227***	0.115***	1				
REG	0.003	-0.047*	0.015	-0.002	-0.016	0.125***	1			
LIQ	-0.052*	0.298***	0.414***	-0.055**	-0.026	-0.126***	-0.003	1		
CP	0.138***	-0.084***	0.175***	0.044*	-0.243***	0.058	0.028	0.011	1	
BC	-0.17	0.428***	0.068***	0.011	0.003	-0.011	0.026	0.123	-0.079***	1

3.2 Empirical findings

3.2.1 CD and CP

Table 4 shows the empirical findings of the correlation between CD and CP (Panel 1). Impact of CD on CP is investigated using two empirical evaluations. The first is the "Ordinary Least Squares (OLS)" regression, and the second is the "Instrumental Variable-two-Stage Least-Squares (IV-2SLS)" model, which addresses the endogeneity issue in CDS/CP systems. These

findings show that more transparency about carbon emissions leads to less pollution overall. In other words, there is a strong inverse correlation between the CD and the CP.

Enhanced carbon disclosure, in line with the 'outside-in' management approach, motivates companies to refine their carbon strategy and cut their emissions. This suggests that carbon disclosure might be used by businesses to spark interest and action inside the organization to improve social and environmental conditions. That's why the CDP and other sustainability institutions are putting so much emphasis on greenhouse gas emissions. The study was expanded by splitting the sample in half, with one group consisting of companies with high CD and the other comprising companies with low CD, to test the reliability of the findings. Table 4 (Panel 2) shows that when comparing companies with high and low carbon disclosure, the latter tend to have fewer emissions.

Extensive Investigations

Effect of industry

We investigate the possible impact that the business world might have on the connection of interest. The media and a larger section of the public, in addition to regulators, are placing a greater emphasis on high-GHG generating businesses. In accordance with the standards provided by the Global Industry Classification Standard (GICS), our sample includes both intensive and non-intensive industries, bringing the total number of sectors to nine after financial enterprises are removed. In order to investigate the possibility of their being a difference across industries, the sample was divided into two subsamples: one consisted of intensive industries, while the other consisted of non-intensive businesses. An OLS regression test was carried out with the purpose of determining the possible impact that industry may have on the CDS-CP connection.

The results, which are shown in Table 4 (Panel 3), show that the carbon intensive subsample has a very negative relationship. For the non-intensive subsample, there was no significant relationship found. These results back up the finding that most companies that are sensitive to the environment make voluntary environmental disclosures. As a possible outcome, less raw resources and trash will be wasted as a consequence of more efficient utilization of inputs. The combined effects of these two factors result in less pollution.

Financial crisis effect

Considering the study's sample period, that spans the years 2017 to 2021. Then, a test was conducted to identify any potential influence of the financial crisis on the interest relationship.

Table 4: The relationship between CD and CP

CP Model	Panel 1		Panel 2		Panel 3		Panel 4	
	OLS	IV-2SLS	High-CDS	Low-CDS	Intensive	Non-Intensive	Crisis	Recovery
SIZE	103.648***	91.237*	-245.907	14.955***	113.136**	-9.036	-80.078	107.666**
LEV	1.431	5.196	38.063	0. 808***	-2.173	0 .056	4.440	-0.434
FP	-13.194	-20.788	-1.098	-1.847**	-15.447	-5.024**	32.113	-24.587
LIQ	191.246*	159.614	364.672	-6.580	355.024*	-30.218***	-103.882	204.482*
BC	-39.047	-29.942	290.232	-15.401***	-33.696	8.726	202.755	-54.769
REG	258.365	1577.450	810.006	10.287	280.891	66.098		317.559
R^2	0.05	0.08	0.19	0.10	0.07	0.10	0.06	0.06
N	957	741	179	778	734	223	115	842
CDS	-9.853**	-17.416**	-45.078**	0 292	-12.436**	1.053	-4.214	-9.109**
S.GROW	-24.512	-1015.962	-94.489	-18.263	-21.468	-68.629*	-413.068	-22.013
GROW	618.14	1093.080	4244.824	0. 770	890.576	23.513	-158.322	618.862
Constant	-1612.827**	-1187.281*	5791.276	-193.007**	-1835.863**	302.342**	1540.317	-1544.586**
YEAR Effects	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

The symbols *, **, and *** indicate that the significance level is, 1, 5, and 1 percent respectively (two-tailed test). Table 4 (Panel 4) shows that the CDS-CP correlation is not significant during the midst of the financial crisis, but that it becomes significantly adversely significant during the ensuing period of economic recovery. This finding suggests that businesses may have to temporarily scale down their investments in emission reduction measures in response to the current crisis.

Conclusion

This study is being carried out against the backdrop of growing public concern about climate change and an increasing interest in green financing. The need for a deeper comprehension of the connection that exists between CD and CP is the motivation for the study. This research examines the impact of CD on a company's CP via the perspective of outside-in management to give explanations and empirical evidence. This method to management examines at problems from the outside in. According to the results, there is a statistically significant inverse correlation between voluntary CD and CP. Furthermore, by choosing the time frame we did, we were able to account for any possible impact the financial crisis may have had on this connection. The results show that CD had no impact on CP throughout the crisis years. In contrast, more carbon reporting is linked to improved carbon performance throughout the financial crisis recovery period. Our research also included a comparison of sectors with and without high carbon emissions, and we discovered that the link between CD and CP is more pronounced in sectors with high carbon emissions. Finally, we split the sample into high and low carbon disclosure businesses to test the validity of our findings, and found that high CD was related with low emissions while low CD was associated with high emissions. This research provides empirical data to support the use of CDP reporting to gauge carbon performance across enterprises, which should strengthen the legitimacy of such reporting. Environmental accounting technique

and its implementation, such as the employment of efficient methods for attaining emissions reduction objectives, need to be supported by future policy.

References

1. Sovacool, B.K., Griffiths, S., Kim, J. and Bazilian, M., 2021. Climate change and industrial F-gases: A critical and systematic review of developments, sociotechnical systems and policy options for reducing synthetic greenhouse gas emissions. Renewable and sustainable energy reviews, 141, p.110759.
2. Akbaş, H.E. and Canikli, S., 2018. Determinants of voluntary greenhouse gas emission disclosure: An empirical investigation on Turkish firms. Sustainability, 11(1), p.107.
3. Herold, D.M. and Lee, K.H., 2017. Carbon management in the logistics and transportation sector: An overview and new research directions. *Carbon Management*, *8*(1), pp.79-97.
4. Lu, W., Zhu, N. and Zhang, J., 2021. The Impact of Carbon Disclosure on Financial Performance under Low Carbon Constraints. Energies, 14(14), p.4126.
5. Zhou, Z., Zhou, H., Peng, D., Chen, X.H. and Li, S.H., 2018. Carbon disclosure, financial transparency, and agency cost: evidence from Chinese manufacturing listed companies. Emerging Markets Finance and Trade, 54(12), pp.2669-2686.
6. Li, L., Liu, Q., Wang, J. and Hong, X., 2019. Carbon information disclosure, marketization, and cost of equity financing. International Journal of Environmental Research and Public Health, 16(1), p.150.
7. Pan, A., Zhang, W., Shi, X. and Dai, L., 2022. Climate policy and low-carbon innovation: Evidence from low-carbon city pilots in China. Energy Economics, 112, p.106129.
8. Corrocher, N. and Solito, I., 2017. How do firms capture value from environmental innovations? An empirical analysis on European SMEs. *Industry and Innovation*, *24*(5), pp.569-585.
9. Li, D., Huang, M., Ren, S., Chen, X. and Ning, L., 2018. Environmental legitimacy, green innovation, and corporate carbon disclosure: Evidence from CDP China 100. Journal of Business Ethics, 150(4), pp.1089-1104.
10. Lewandowski, S., 2017. Corporate carbon and financial performance: The role of emission reductions. *Business Strategy and the Environment*, *26*(8), pp.1196-1211.
11. Schiemann, F. and Sakhel, A., 2019. Carbon disclosure, contextual factors, and information asymmetry: The case of physical risk reporting. *European Accounting Review*, *28*(4), pp.791-818.
12. Gallo, P.J. and Christensen, L.J., 2011. Firm size matters: An empirical investigation of organizational size and ownership on sustainability-related behaviors. *Business & Society*, *50*(2), pp.315-349.
13. Fernando, Y., Jabbour, C.J.C. and Wah, W.X., 2019. Pursuing green growth

in technology firms through the connections between environmental innovation and sustainable business performance: does service capability matter?. *Resources, Conservation and Recycling*, *141*, pp.8-20.

14. Danso, A., Adomako, S., Amankwah-Amoah, J., Owusu-Agyei, S. and Konadu, R., 2019. Environmental sustainability orientation, competitive strategy and financial performance. *Business Strategy and the Environment*, *28*(5), pp.885-895.
15. Haque, F., 2017. The effects of board characteristics and sustainable compensation policy on carbon performance of UK firms. *The British Accounting Review*, *49*(3), pp.347-364.