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Factors Affecting Climate Change Accounting Disclosure Among Saudi Publicly List Firms on the Saudi Stock Exchange Market*

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Abstract

This study's goal is to investigate the effects of board size, the number of annual board meetings, the profitability of the company, and the audit Committee on the disclosure of climate change in Saudi companies listed on the stock exchange. It was conducted to evaluate affecting some factors on carbon emissions by the regression model. The study uses the content analysis method. Data was collected from the annual and sustainability reports, and the platform database Refinitiv, an LSEG (London Stock Exchange Group Company) for the period 2018 to 2021. The study sample is 51 companies. The study findings showed Saudi Arabia saw its first significant overall drop in CO₂ emissions with a 22.61 MtCO₂ decline (3.93%) in 2018. The study revealed a positive connection between the size of the director's board, and the disclosure of carbon emissions in Saudi firms listed on the stock market. While other factors are not related to the number of director's board meetings, the audit committee, and the profitability of the company on the disclosure of carbon emissions in the Saudi companies listed on the stock exchange.

Keywords: Climate Change, Board Size, Audit Committee, Company Profitability

JEL Classification Code: M14, M41, M42, M49

1. Introduction

Climate change and related issues, such as carbon emissions, represent a strategic challenge for the business environment. World leaders and non-profit organizations have called for businesses to be more accountable for climate change concerns. As a result, firms consider climate change disclosure, such as carbon disclosure, as an effective way that firms can be used the show their accountability.

As a result, growing demand from corporations' stakeholders to firms' management to report more carbon information within reports. In response to such demand, several non-governmental organizations have undertaken initiatives for firms to be more transparent regarding carbon emissions performance (Ooi, 2016). The subject of climate change has gone worldwide, attracting more public knowledge, which led to tougher laws, regulations, and social expectations of organizations, while the government gives on contributing to addressing climate change and implementing the SDGs enough priority (Saha et al., 2021). It has become more difficult for policymakers to address the issue of carbon emissions because of the rising effects of global warming caused by an increase in carbon emissions. Due to the growth in production and manufacturing levels, as well as good consumption levels due to the increase in population around the world (Chen et al., 2021).

Concerns about business greenhouse gas emissions (GHGs) and their role in global warming. Companies are consequently under pressure from many stakeholders to report on their strategies for addressing climate change and the danger and possibilities it brings with it. Many nations have recently strengthened their environmental laws in response to the difficulties posed by climate change and implemented legislation for the reduction of GHG emissions

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(Mateo-Márquez et al., 2020). Since the World Health Organization (WHO) declared COVID-19 to be a global pandemic, customers have been panic buying food and health supplies, such as masks, and hand sanitizers, on a large scale. Also, governments' distancing yourself physically and socially is a choice you've made and stopped traveling; as a result, people spend more time in the digital realm, whether for work, communication, shopping, or entertainment (Hayu et al., 2021). The epidemic led to global economic, social, and cultural crises due to the introduction of emergency lockdowns, partial lockdowns, inter-state travel restrictions, and total closure of business. This situation has led to new norms such as social distancing, the limitation of persons at public gatherings, and the uptrend in online activities (Mustafa et al., 2021).

Firms are under a lot of pressure to include environmental information in their annual reports. These demands come from various social groups, including the firm's stakeholders and the government. Additionally, the desire to improve the firm's performance and the concern about losing its good name motivate the company to share environmental information (Elshabasy, 2018). Thus, firms have started to voluntarily react to climate change concerns by disclosing information on carbon emissions using different disclosure or communication channels. However, both corporate annual reports and the carbon disclosure project (CDP) are the most used disclosure channel for carbon information (Depoers et al., 2016). Despite, the increasing rate of firms providing carbon information and due to the voluntary climate change's kind disclosure. The information on carbon provided by firms is still relatively low and insufficient to meet the growing demand of firm stockholders. This can be linked to several reasons such as a lack of standardization for carbon accounting (Borghei, 2021).

Environmental concerns have become a subject of growing relevance in the accounting literature in recent decades, especially issues related to industrial activities, the financial and non-financial performance of businesses, transparency, and environmental reports, in industrialized nations. However, many studies haven't been published in emerging nations, especially in the Arab region (Alhaj, 2019). Based on the nature of accounting information and its purpose for providing different information, which meets the shift toward pressing social and environmental issues, the accounting profession sees itself as essential to the development of disclosure practices that can aid broader public decision-making. Accountants now have a larger role in the disclosure of environmental data coming from public and private enterprises, non-governmental organizations, and government agencies (Andrew & Cortese, 2011a).

The adoption of the Kyoto Protocol (KP) in 1997 prompted government regulatory agencies to think about strategies to reduce carbon emissions and to create policies and/or rules governing the sharing of carbon information.

Moreover, pressure to promote GHG reporting has come from volunteer projects like the Carbon Disclosure Project (CDP). The European Union (EU) published directives encouraging businesses to form environmental committees (ECs) voluntarily to encourage businesses to improve their carbon performance and disclosure. These groups might provide top management with recommendations on how to cut emissions and create carbon disclosure guidelines that would satisfy the information requirements of diverse stakeholders (Jaggi et al., 2018).

Pollution is a growing concern as Saudi Arabia advances economically. The Saudi Arabian General Investment Authority emphasizes the significance of increased accountability and transparency about a company's environmental performance. Furthermore, the ISO 14000 standards for the International Organization for Standardization (ISO) identify environmental performance as a crucial company strategic concern. Many businesses are voluntarily expanding their degree of environmental disclosure through various sources and media in response to investors and the concerned interests in company practices (Boshnak, 2022). Saudi Arabia is regarded as one of the top oil exporters globally and is a member of the G20; the government is making major efforts to attract foreign investment and transition the country's economy from one that is heavily dependent on oil to one that is well diversified. Saudi Arabia's capital market is improving quickly in line with Saudi Vision 2030 after adopting the disclosure rules at the end of 2021 (Chebbi & Ammer, 2022). In September 2006, Saudi Arabia hosted the first regional Clean Development Mechanism (CDM) meeting in Riyadh after ratifying the Kyoto Protocol in May 2005. Additionally, Saudi Arabia played a key role in the creation of the Bali Roadmap in December 2007, and the country also took part in the UNFCCC conferences in Poznan, Copenhagen, and Cancun. An event conducted by Saudi Aramco in the city of Dammam in May 2006 focused on carbon management and mitigation strategies in Saudi Arabia, with an estimated four hundred attendees representing over one hundred organizations and businesses from twenty-four countries (Hashmi & Al-Habib, 2013). The gas that was captured was utilized to run desalination plants, power plants, and industrial cities like Jubail and Yanbu. In 1980–1985, these measures caused a 68% decrease in Saudi Arabia's GHG emissions. Enerdata reported a decrease in overall CO₂ emissions in Saudi Arabia of 22.61 MtCO₂ (3.93%) in 2018. The IEA recorded a decrease in CO₂ emissions from fuel combustion of 24.97 MtCO₂ (4.83%), while Enerdata reported a decrease of 21.69 MtCO₂ (3.93%) (Shehri et al., 2022).

The study investigates some factors which affect the disclosure of climate change, especially carbon emissions in the Kingdom of Saudi Arabian, which characteristics of board directors, environmental committees, and the audit

community. Also, the study aims to fill the gap in studies on such factors influencing the disclosure of carbon emissions in Arabian countries in general and the Kingdom of Saudi Arabian in particular. The main question of the study represented the problem statement of the study: Are there factors that impact the disclosure of carbon emissions in Saudi firms? Divide the main question into the following sub-questions: Are there characteristics of board directors on disclosure of carbon emissions in Saudi firms? Are there environmental committees on the disclosure of carbon emissions in Saudi firms? Are there audit committees on the disclosure of carbon emissions in Saudi firms?

2. Literature Review

2.1. Climate Change

Since there is a growing worry about climate change on a global scale, authorities, and governments, both at both local and global levels, are now paying close attention to carbon emissions. Carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, and chlorofluorocarbons are all considered greenhouse gases (GHGs) under the Kyoto Protocol. Often, the carbon dioxide equivalents of these GHGs are used as measurements (CO₂-e). Carbon emissions disclosures and the evaluation and reporting of the financial repercussions of carbon are the three main types of reportable information on carbon emissions (Green & Zhou, 2013).

The operations and financial performance of businesses could be dramatically impacted by the physical effects of climate change. These physical dangers could cause a company's tangible assets to be damaged, higher operating costs, or a shortage of essential input factors. Recent estimates put a US \$4.2 trillion figure on the present value of global projected losses in assets that may be managed that are due to the direct effects of climate change. Due to the serious financial risks posed by both the direct and indirect regulatory and market-based effects of climate change, investors have become increasingly interested in voluntary corporate reporting on this topic (Schiemann & Sakhel, 2019). Climate change is a global problem, especially in developing countries, which depend on agricultural production most affected by climate change, are poor adaptability, difficulties in livelihood transformation, and sustainable livelihood options, those most affected are vulnerable groups (Thu et al., 2022).

The quality of life on earth is seriously threatened by global warming, which is caused by carbon emissions. Which is worried about the effects of pollution on human health, and the financial community, which is worried about how the company's carbon policy will affect value creation. Numerous parties are exerting pressure on the company, including the public, and non-governmental organizations

(NGOs) that are regularly concerned about corporate social responsibility (CSR) (Depoers et al., 2016). Investor confusion will be decreased by the companies' disclosure of carbon information, ease financial constraints and achieve tangible economic benefits to improve their corporate value, However, other academics contend that the rising cost of low-carbon energy has a detrimental effect on corporate value (Yan et al., 2020).

In the middle of the 2000s, several organizations began to disclose information about their objectives and plans for reducing greenhouse gas (GHG) emissions, a practice known as "carbon disclosure." Organizations have tried to address the growing public concern about climate change and its consequences in this way (Gonzalez & Zamora, 2016). Companies in Canada are required to report their firm- and facility-level GHG emissions. All facilities that emit the equivalent of 50 000 tonnes or more of GHG in carbon dioxide equivalent units per year are required to report their emissions under Environment Canada's Greenhouse Gas Emission Reporting Program (Ben-Amar & McIlkenny, 2015). A national carbon emissions trading market must be established to implement the Chinese government's intentions to reduce greenhouse gas (GHG) emissions. This should be done after December 30, 2014. According to the carbon trading system, if a company's GHG emissions go above the free allocation cap set by the government for a given period, the extra quota must be bought on the market, which will have an impact on corporate profitability (Tan et al., 2020).

Due to increased public awareness of climate change, its effects on business and society, and ongoing calls for accountability from the financial sector, carbon disclosure has grown dramatically in recent years. Globally, nations are creating policies, particularly for environmental protection by disclosing carbon data. Most companies are starting to offer an especially useful appraisal of the financial risks associated with climate change. The financial community is focused on assisting firms to understand their performance in the sector, identifying which companies are affected by climate legislation, and working to increase stakeholder and investor trust (Zang et al., 2015). Researchers, stakeholders, and regulators are paying increased attention to carbon information disclosures (CID), strategy businesses utilize to combat climate change by disclosing standard information about their greenhouse gas emissions. CID enables stakeholders, like the public and the government, to monitor and regulate corporations' carbon emissions, boosting corporate environmental performance more effectively (Peng et al., 2015).

Carbon information disclosures improve corporate transparency, lower financial risk, and aid in the reduction of information asymmetries. They also serve as a pertinent variable when comparing the risk profiles of various firms.

One component of the environmental disclosures that businesses publish is GHG information, and environmental initiatives enhance their standing with a broader range of stakeholders. However, market participants severely penalize businesses whose GHG emissions are not properly disclosed. Additionally, media coverage influences carbon information and lowers the COE of polluting-listed companies, enhancing the firms' reputation among many stakeholders (Garzón-Jiménez & Zorio-Grima, 2021).

Several projects aim to use institutional investors' power to increase demand for carbon disclosure as an addition to traditional financial systems. Among the most well-known is the Carbon Disclosure Project (CDP). Institutional investors' worries about climate change are addressed by CDP, an independent, non-profit organization with headquarters in the United Kingdom (He et al., 2013). The CDP was established in Britain in 2000. Its goal is to collect as much climate-related data as possible from businesses and make it available to the public. As an "independent, not-for-profit firm having the world's largest database of primary business climate change data," the CDP gathers this data on behalf of institutional investors. The CDP annually sends out a request for information to businesses worldwide, requesting data concerning greenhouse gas emissions, emission reduction targets, climate change risk, management strategies, and prospects for improvement (Andrew & Cortese, 2011b).

2.2. Factors Affecting Climate Change Disclosure

An indication of a company's involvement in environmental changes, particularly global warming, is the disclosure of carbon emissions. Annual reports and sustainability reports typically disclose carbon emissions. To exist, a company's operations must be guided by the values and social standards prevalent in the community. Therefore, corporations now need more information about environmental disclosure, particularly about carbon emissions. Disclosure of carbon emissions is impacted by numerous factors, such as the industry type, the level of carbon emissions, the size, the age, the profitability, and the institutional ownership structure (Akhroh, 2016).

2.2.1. Board Size (BS)

The board of directors, which serves as the backbone of the corporate governance system, oversees preserving the interests of the corporation's shareholders by overseeing its operations and providing guidance for its decision-making. They also make decisions regarding corporate policy, ensure company profitability, and return on shareholder investments, and are concerned about the negative impact of global warming and the health concerns associated with it (Gardazi et al., 2020).

Since larger boards offer greater diversity in terms of experience and greater ability for management supervision, board size can be considered as a corporate governance instrument that may influence the extent of voluntary corporate disclosure, including environmental disclosure. Increasing the number of directors with financial or accounting experience may result in a larger board, which could improve corporate environmental transparency (Akbas, 2016).

The number of directors on a board is referred to as the "board size." There is no explicit law specifying how many people should be on the board of directors, but it is recommended that there be a group of 3 to 15 people with a variety of specialties and managerial backgrounds who are chosen directly by the shareholders to make sure that the administration is performing in the best interests of all stakeholders. According to another researcher, depending on the size, sector, and nature of the organization, the appropriate board size ranges from 5 to 16 members. The Saudi Capital Market Authority's corporate governance guidelines state that the number of members on a board of directors should range from three to eleven (Alotaibi, 2020).

2.2.2. Number of Meetings (NM)

Active directors' board is more powerful because frequent board meetings allow directors to oversee the business's performance more closely and give them a tendency to disclose more voluntary information. The frequency of board meetings is positively correlated with greater disclosure of information (Issa, 2017). It is a metric used to measure the board's performance in corporate governance. The management of corporate operations and transparency by boards that hold frequent meetings is likely to satisfy a variety of stakeholders. It is used to assess whether managers are carrying out their responsibilities professionally, as well as a gauge of the board's thoroughness. Because participation in board meetings demonstrates the board members' dedication to planning and making decisions, particularly those concerning CSR issues. Saudi Arabian legislation on corporate governance stipulates that the board shall meet at least four times a year (Alotaibi, 2020).

2.2.3. Company Profitability

The ability of a business to turn a profit is known as profitability. This can be assessed by examining both the profit and loss account and the company's growth over a sustained period. Companies to provide more information and justify their existence in the community (Johan, 2021). Profit is defined as net income after all business-related expenses are subtracted from the business's revenue. In this study, the ability of the company to make profits through the total return on assets (ROA), which is used to show

the profitability of the company, measures the amount of money spent on the activities utilized by its operation. It is reasonable to assume that a company can afford to disclose more information if it is profitable for its shareholders. Additionally, successful performance improves a company's reputation and opens up new options (Alotaibi, 2020)

2.2.4. Audit Committee(AC)

It is a board of commissioners responsible committee that supports the board in managing internal and external audit operations. Members are more independent and devoid of any vested interests, which helps guarantee a higher standard of financial reporting (Januarti et al., 2020). The audit committee, a specialist division, oversees making sure that the management-produced financial statements are accurate and reliable. The audit committee oversees monitoring the independent audit, the performance of the board of directors, and the manager, and increasing operational effectiveness so that investors have more faith in financial statements (Ngo & Le, 2021).

The financial expertise of members can help to easy for overseeing the corporate reporting process, acts to ensure that the firm's financial disclosures provide reliable information, and ensure that there are no substantial misstatements and that the information reported in the financial statements is correct (Felo et al., 2005). Three to five independent members, the majority of whom must possess financial competence, should make up an AC. Additionally, the appointment of executive management as a member of the AC is prohibited since the chair of the AC must be either a non-executive director or an independent member of the corporate board of directors. The formation of an AC has as its goal assisting the corporate board of directors in carrying out its oversight role and providing reasonable assurance regarding the quality of financial reporting, the effectiveness of internal auditing, and the independence of external auditors (Salehi & Shirazi, 2016).

2.3. Hypotheses

Many researchers are interested in the factors affecting the disclosure of carbon emissions for various economic sectors.

In light the Carbon Disclosure Project (CDP), Corona pandemic situation in US firms (Stanny, 2013) disclosing emissions and disclosing accounting methodology for emissions investigated the voluntary disclosure of greenhouse gas emissions made by (CDP). From 2006 to 2008, trends in three disclosures—responding to the questionnaire, declaring emissions, and revealing the emissions accounting methodology—were evaluated. The findings revealed that while many businesses responded to the questionnaire,

they did not disclose their emission quantities or how they account for them, and many only provided the bare minimal information to avoid being scrutinized.

Bae Choi et al. (2013) explained the volume of voluntary carbon emission disclosures made by significant Australian companies between 2006 and 2008, an explanation of the Australian carbon emissions reporting system, and a determination of the factors that explain the volume of carbon disclosures from annual reports and sustainability reports of individual companies Results showed that the carbon disclosure score had significantly increased, that larger, more visible companies tended to make more thorough carbon disclosures and that the National Greenhouse and Energy Reporting Act (the NGER Act), legislation passed in 2007, had encouraged voluntary disclosures of carbon emission levels.

Hashmi and Al-Habib (2013) examined secondary and primary data regarding the application of sustainability and carbon management approaches by Saudi Arabian corporate firms. To identify small variations between the declared goals and perceptions of managers inside Saudi Arabian organizations, a questionnaire was given to about 150 middle managers in Saudi Arabia. As a result, it was discovered that businesses were at least attempting to implement sustainability and carbon management strategies and that managers were not entirely satisfied with their efforts.

Gonzalez and Zamora (2016) examined the variables influencing organizations' decisions to disclose carbon information, as well as the degree of transparency of such information, for the Spanish enterprises who were invited to reply to the CDP questionnaire in 2012. The findings demonstrate that social, commercial, shareholder, and international pressures have an impact on carbon disclosure and its transparency level. The size of the company, financial risk, its inclusion in the IBEX35 and FT500 indexes, and ownership concentration have all demonstrated a higher impact in the Spanish situation.

Akbas (2016) examined the relationship between board independence, gender diversity, board size, and audit committee, as well as the level of environmental disclosure in Turkish firms' annual reports. Only board size, according to the findings, has a statistically significant and favorable correlation with the degree of environmental disclosure. On the other hand, it is discovered that the remaining independent variables have no connection to how much information is disclosed about the surroundings.

Also, Akhiroh (2016) investigated the impact of organizational visibility, financial health, and corporate governance mechanisms on carbon emission disclosure in Indonesia and was examined to gather empirical data. The Carbon Disclosure Project's index checklist served as a gauge for carbon emission disclosure. Multiple regression analysis and descriptive statistics were employed in

the analysis. According to the findings, organizational visibility, financial success, managerial control, and the audit committee, all had a substantial impact on how much information was disclosed about carbon emissions. The degree of carbon emission disclosure, however, was not significantly impacted by environmental performance, financial difficulties, institutional ownership, or the number of independent commissioners.

Pitrakkos and Maroun (2020) examined the variations in the breadth and depth of disclosures related to greenhouse gas emissions among footprinting firms. It also considers whether disclosures are made in the sustainability report or the integrated report. The number and caliber of carbon disclosures made by 50 businesses listed on the Johannesburg Stock Exchange are evaluated using content analysis. The study's findings revealed that firms are unwilling to commit to high-quality reporting on concrete efforts being taken to reduce carbon emissions and that carbon disclosures are used as a means of appeasing stakeholders.

Saraswati et al. (2021) investigated how carbon emission disclosures in Indonesian enterprises are impacted by profitability, company size, board independence, and board gender diversity. The manufacturing firms that were consecutively listed on the Indonesian Stock Exchange from 2015 to 2018 make up the sample for this study. Multiple regression analysis was used to measure the disclosure of carbon emissions. According to the report, firms with higher profits and larger sizes also disclose their carbon emissions more frequently, as do businesses with significant numbers of female and independent directors.

Mateo-Márquez et al. (2021) Analyze the impact of the various regulatory context elements (rules, monitoring mechanisms, rewards, and penalties) on firms' propensity to disclose carbon information as well as the quality of disclosures based on (CDP). The findings demonstrate that regulatory elements positively influence businesses' decisions to voluntarily disclose carbon data and that rules and incentives related to climate change have a positive impact on the quality of disclosures but have no bearing on monitoring systems and sanctions related to climate change.

Salleh et al. (2022) explored whether the audit committee's (AC) efficiency affects how Malaysian publicly listed businesses report their greenhouse gas (GHG) emissions. and the extent of GHG emissions disclosure in the annual and sustainability reports from 2016 to 2019. This study found a deeper understanding of AC's roles—beyond the usual and required ones to supervise the financial reporting process—was gained. Also provided was empirical proof that the effectiveness of AC improves corporate disclosure practices.

Boshnak (2022) examined the factors that determine corporate social and environmental voluntary disclosure policies in Saudi-listed companies, considering business characteristics and ownership structure. For online annual

report data from 2016 to 2018, it employs manual content and regression analyses. According to the findings, the implementation of IFRS and other corporate governance standards led to an increase in the average disclosure of 68% of business characteristics and ownership structure. For online annual report data from 2016 to 2018, it employs manual content and regression analyses. According to the findings, the implementation of IFRS and other corporate governance standards led to an increase in average disclosure of 68%. Additionally, government ownership, company size, leverage, the manufacturing industry, and the kind of ownership are all favorable, whereas family ownership is unfavorable. However, the level is unaffected by firm size, age, profitability, or institutional ownership.

3. Research Methodology

This study investigates If disclosure of Saudi companies' climate change disclosure issues (carbon emissions) is influenced by board meetings, the board size, the audit committee, and company profitability. The study uses the content analysis method. It uses a sample of Saudi companies listed in the stock exchange market of Saudi (Tadawul). This study covered the years 2018–2021. This period comes after Saudi corporate governance reforms were adopted in 2017; the Saudi Stock Exchange had 206 companies listed by the end of 2021. A final sample of 51 companies was left after the removal of companies with no or insufficient data on the study's variables. Data was collected from annual and sustainability reports and the platform database Refinitiv, an LSEG (London Stock Exchange Group Company).

4. Research Model

Based on the literature evaluation and in consideration of the research aims, the study model that reflects the anticipated relationship between the dependent and independent variables has been built.

The study model looks like this (Table 1):

$$CC_{it} = \beta_0 + \beta_1 (BM_{it}) + \beta_2 (BS_{it}) + \beta_4 (AC_{it}) + \beta_2 (CPC_{it}) + U_{it}$$

5. Results and Discussion

5.1. Descriptive Analysis

It uses descriptive analysis to give a broad overview of the study variables. The extent of climate change disclosure (CC) is the dependent variable (business implications and opportunities of climate change). It is expressed as an average (%) and calculated as the ratio of the company's average disclosures to all disclosures.

Table 1: The Study Variables' Definitions

Symbol	Definition	Measurement
BM	BM	The number of board meetings held by the company each year
BS	BS	The firm's overall directors count for the year.
CP	CP	Monitoring financial reporting and disclosure process
CP	CP	The ratio of net income to total assets for company j over the period t is used to calculate the return on assets.
CC	CC	Assessment or description of the financial, business, and opportunity effects of climate change in the present and the future

Table 2: Descriptive Statistics of a Dependent Variable and Independent Variable

Variables	Mean	Median	Maximum	Minimum	St. Deviation
BM	5.9216	6.000	14.00	4.00	18.87449
BS	9.6078	9.000	20.00	6.00	2.11734
CP	5.012353	2.600	23.30	0.000	5.6719575
CP	0.4118	0.00	0.00	1.00	0.49705
CC	0.2549	0.00	1.00	0.00	0.44014

Table 3: Correlation Matrix-Person Test

Variables	BM	BS	CP	AC	CC
BM	1				
BS	0.168	1			
CP	0.078	0.252	1		
CP	-0.157	-0.016	0.056	1	
CC	0.073	-0.234	0.059	-0.074	1

Table 2 shows the average disclosure for Saudi-listed companies is 0.2549, which means that only 25% of future financial and business implications and opportunities of the climate change index are typically revealed by companies listed on the Saudi stock market.

5.2. Correlation Analysis

A correlation analysis was used to ascertain the connection between the independent factors and the dependent variable. The exam is carried out to find any potential multicollinearity. Whenever the factors have a significant intercorrelation, multicollinearity occurs. The results of regression analysis may be distorted by significant intercorrelation; thus, it is possible to separate the variables with high correlation to ensure a valid result.

Table 3 presents the findings of the correlation analysis. It demonstrates that a 25.2% correlation exists between the

independent variables. This is between the board size and firm profitability. 16.8% is the next-highest correlation between board meetings and board size. No other independent variables with a substantial association were discovered when these were considered. Therefore, it can be said that there is no chance of multicollinearity.

5.3. Regression Analysis

The first hypothesis seeks to determine the compatibility of the board meetings and the extent of climate change disclosure. The results of the multiple regression show a non-significant negative association ($\beta_1 = 0.024$, t -statistic = 0.0691), recommending that the board meetings without influence on what degree of the independent variable (CC). Whereas the p -value = 0.493%, is greater than 10%. As a result, this hypothesis is rejected.

The second hypothesis attempted to test the relationship between the board size and the extent of climate change disclosure. The results of the multiple regression show a significant association ($\beta_2 = -0.059$, t -statistic = -1.926), recommending that the board size influences what degree to the independent variable (CC). whereas the p -value = 6%, is less than 10%. As a result, this hypothesis is accepted.

The third hypothesis investigated the relationship between the audit committee and the extent of climate change disclosure. The results of the multiple regression show a non-significant negative association ($\beta_2 = 0.112$, t -statistic = 0.867), recommending that the audit committee without

Table 4: Regressions Analysis

Symbol	Definition	Coef		t-statistic	P < t
Cons	Model Constant	B0	0.663	1.967	0.055
BM	Board Meeting	B1	0.024	0.691	0.493
BS	Board Size	B2	-0.059	-1.926	0.060
AC	Audit Committee	B3	0.112	0.867	0.391
CP	Company Profitability	B4	0.005	-0.488	0.628
Additional Statistic:					
N = 51	F-value = 1.087	Prob F = 0.374		Overall R ² = 0.086	

Adjusted R-squared = 0.007.

influenced by what degree of the independent variable (CC), whereas the p -value = 0.391, is more than 10%. As a result, this hypothesis is rejected.

The fourth hypothesis investigated the relationship between the company's profitability and the extent of climate change disclosure. The results of the multiple regression show a non-significant negative association ($\beta_2 = -0.005$, t -statistic = -0.488) recommending that the company profitability without influence what degree of the independent variable (CC). whereas the p -value = 0.628%, is more than 10%. As a result, this hypothesis is rejected.

5.4. Discussion

The study found the validity of only one hypothesis, which is the existence of a role for the size of the board of directors in the disclosure of carbon emissions by Saudi companies. On the other hand, there is no effect of the factors of the number of annual board meetings, the audit committee, and the company's profitability in disclosing carbon emissions. These results are consistent with Akbas (2016), which concluded that there is an effect of the size of the directors' board on environmental disclosure, while there is no effect of the factors of the independence of the board, the audit committee, and gender diversity on the environmental disclosure in Turkish companies. Also, is consistent with Boshnak (2022) who concluded that there is no impact of the company's profitability on voluntary disclosure in Saudi companies.

These results differ from the study of (Akhiroh, (2016), which concluded that the profitability of the company and the audit committees have an important role in impact on the disclosure of carbon emissions. Also, Saraswati et al. (2021) concluded that the most profitable Indonesian companies are those that disclose Carbon emissions Also, Salleh et al. (2022) consider the effectiveness of the audit committee in disclosing carbon emissions in Malaysian companies.

Hashmi and Al-Habib (2013) found that Saudi corporate managers are dissatisfied with the practices of employers with carbon disclosure. Pittrakkos and Maroun (2020) found that companies in South Africa are reluctant to commit to preparing reports on carbon emissions. Also, a study by Mateo-Márquez et al. (2021) concluded that regulatory rules positively affect the disclosure of information related to climate change. The researchers believe that the lack of rules and instructions from the Saudi Stock Exchange for listed companies to disclose carbon emissions is the main factor in the insufficient disclosure of carbon emissions by Saudi companies.

6. Conclusion

The study aimed to analyze and measure the impact of the board size, the number of annual board meetings, the audit committee, and the profitability company on the disclosure of the carbon emissions of Saudi companies with stock market listings. Data was gathered from the annual and sustainability reports for 2018 to 2021. It was found that a positive connection between the size of the directors' board and the disclosure of carbon emissions in Saudi companies listed on the stock exchange. While there is no connection between the number of annual board meetings, the audit committee, and the company's profitability. The research findings can assist regulators in creating appropriate legislation that focuses on sectors and particular business practices where relevant stakeholders place the most value on disclosure.

This study contributes in three ways. First, carbon disclosure is an emerging field, and the number of studies investigating the issues is quite limited and scarce. Hence, conducting this study is expected to provide additional evidence about carbon disclosure quality in developing countries and emerging markets, namely Saudi Arabia thence expanding the existing literature. Second, This study adds to the body of knowledge regarding the relationship

between national bodies and corporate board arrangements and disclosure of carbon emissions. Specifically, it examines how the bolsters Saudi Capital Market Authority practices and disclosures. Finally, beneficial for many groups, such as regulatory bodies, policymakers, investors, and listed company management, to evaluate Saudi firms' response to climate change issues.

The study is also subject to limitations. The main limitation of this research is that study four factors affecting (the size of board directors, the number of board meetings, profitability, and the audit committee). While it did not address many of the elements that influence how carbon emissions are disclosed such as the type of industry, the level of carbon emissions, the size of the company, the age of the company, gender diversity, and the institutional ownership structure that influence how carbon emissions are disclosed.

Future research should continue to examine the effects of other factors on climate change disclosure in Saudi firms with stock exchange listings. It should examine and compare the effect these factors have on petroleum companies' activities in Arab gulf countries, to continue to adjust their policy program with more environmentally friendly economic activities.

References

- Akbas, H. E. (2016). The relationship between board characteristics and environmental disclosure: Evidence from Turkish listed companies. *Southeast European Journal of Economics and Business*, 11(2), 7–19. <https://doi.org/10.1515/jeb-2016-0007>
- Akhiroh, K. K. T. (2016). The determinant of carbon emission disclosures. *Accounting Analysis Journal*, 5(4), 326–336.
- Alhaj, A. (2019). Sustainability disclosure on environmental reporting: A review of literature in developing countries. *American Based Research Journal*, 8, 01–13.
- Alotaibi, M. M. (2020). Determinants of sustainability disclosure of Saudi listed companies. *Journal of Economics and Sustainable Development*, 11(2), 83–97. <https://doi.org/10.7176/JESD/11-2-09>
- Andrew, J., & Cortese, C. (2011a). Accounting for climate change and the self-regulation of carbon disclosures. *Accounting Forum*, 35(3), 130–138. <https://doi.org/10.1016/j.accfor.2011.06.006>
- Andrew, J., & Cortese, C. (2011b). Carbon disclosure. *Australasian Accounting, Business and Finance Journal*, 5(4), 5–18.
- Bae Choi, B., Lee, D., & Psaros, J. (2013). An analysis of Australian company carbon emission disclosures. *Pacific Accounting Review*, 25(1), 58–79. <https://doi.org/10.1108/01140581311318968>
- Ben-Amar, W., & McIlkenny, P. (2015). Board effectiveness and the voluntary disclosure of climate change information. *Business Strategy and the Environment*, 24(8), 704–719. <https://doi.org/10.1002/bse.1840>
- Borghei, Z. (2021). Carbon disclosure: A systematic literature review. *Accounting and Finance*, 61(4), 5255–5280. <https://doi.org/10.1111/acfi.12757>
- Boshnak, H. A. (2022). Determinants of corporate social and environmental voluntary disclosure in Saudi listed firms. *Journal of Financial Reporting and Accounting*, 20(3/4), 667–692. <https://doi.org/10.1108/JFRA-05-2020-0129>
- Chebbi, K., & Ammer, M. A. (2022). Board composition and ESG disclosure in Saudi Arabia: The moderating role of corporate governance reforms. *Sustainability*, 14(19). <https://doi.org/10.3390/su141912173>
- Chen, F., Hussain, M., Khan, J. A., Mir, G. M., & Khan, Z. (2021). Voluntary disclosure of greenhouse gas emissions by cities under carbon disclosure project: A sustainable development approach. *Sustainable Development*, 29(4), 719–727. <https://doi.org/10.1002/sd.2169>
- Depoers, F., Jeanjean, T., & Jérôme, T. (2016). Voluntary disclosure of greenhouse gas emissions: Contrasting the carbon disclosure project and corporate reports. *Journal of Business Ethics*, 134(3), 445–461. <https://doi.org/10.1007/s10551-014-2432-0>
- Elshabasy, Y. N. (2018). The impact of corporate characteristics on environmental information disclosure: An empirical study on the listed firms in Egypt. *Journal of Business and Retail Management Research*, 12(2), 232–241. <https://doi.org/10.24052/JBRMR/V12IS02/TIOCCOEIDAESOTLFIE>
- Felo, A. J., Krishnamurthy, S., & Solieri, S. A. (2005). Audit committee characteristics and the perceived quality of financial reporting: An empirical analysis. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.401240>
- Gardazi, S. S. N., Hassan, A. F. S., & Johari, J. B. (2020). Board of Directors attributes and sustainability performance in the energy industry. *Journal of Asian Finance, Economics, and Business*, 7(12), 317–328. <https://doi.org/10.13106/JAFEB.2020.VOL7.NO12.317>
- Garzón-Jiménez, R., & Zorio-Grima, A. (2021). Effects of carbon emissions, environmental disclosures and CSR assurance on the cost of equity in emerging markets. *Sustainability*, 13(2), 1–11. <https://doi.org/10.3390/su13020696>
- Gonzalez, J. M., & Zamora Ramirez, C. (2016). Voluntary carbon disclosure by Spanish companies: An empirical analysis. *International Journal of Climate Change Strategies and Management*, 8(1), 57–79. <https://doi.org/10.1108/IJCCSM-09-2014-0114>
- Green, W., & Zhou, S. (2013). An international examination of assurance practices on carbon emissions disclosures. *Australian Accounting Review*, 23(1), 54–66. <https://doi.org/10.1111/j.1835-2561.2012.00186.x>
- Hashmi, M. A., & Al-Habib, M. (2013). Sustainability and carbon management practices in the Kingdom of Saudi Arabia. *Journal of Environmental Planning and Management*, 56(1), 140–157. <https://doi.org/10.1080/09640568.2012.654849>
- He, Y., Tang, Q., & Wang, K. (2013). Carbon disclosure, carbon performance, and cost of capital. *China Journal of Accounting*

- Studies*, 1(3–4), 190–220. <https://doi.org/10.1080/21697221.2014.855976>
- Issa, A. I. F. (2017). The factors influencing corporate social responsibility disclosure in the Kingdom of Saudi Arabia. *Australian Journal of Basic and Applied Sciences*, 11(10), 1–19.
- Jaggi, B., Allini, A., Macchioni, R., & Zagaria, C. (2018). The factors motivating voluntary disclosure of carbon information: Evidence based on Italian listed companies. *Organization and Environment*, 31(2), 178–202. <https://doi.org/10.1177/1086026617705282>
- Januarti, I., Darsono, D., & Chariri, A. (2020). The relationship between audit committee effectiveness and audit fees: Insights from Indonesia. *Journal of Asian Finance, Economics, and Business*, 7(7), 179–185. <https://doi.org/10.13106/jafeb.2020.vol7.no7.179>
- Johan, S. (2021). Determinants of corporate social responsibility provision. *Journal of Asian Finance, Economics, and Business*, 8(1), 891–899. <https://doi.org/10.13106/jafeb.2021.vol8.no1.891>
- Mateo-Márquez, A. J., González-González, J. M., & Zamora-Ramírez, C. (2020). Countries' regulatory context and voluntary carbon disclosures. *Sustainability Accounting, Management and Policy Journal*, 11(2), 383–408. <https://doi.org/10.1108/SAMPJ-11-2018-0302>
- Mateo-Márquez, A. J., González-González, J. M., & Zamora-Ramírez, C. (2021). Components of countries' regulative dimensions and voluntary carbon disclosures. *Sustainability*, 13(4), 1–22. <https://doi.org/10.3390/su13041914>
- Ngo, D. N. P., & Le, A. T. H. (2021). Relationship between the audit committee and earning management in listed companies in Vietnam. *Journal of Asian Finance, Economics, and Business*, 8(2), 135–142. <https://doi.org/10.13106/jafeb.2021.vol8.no2.0135>
- Ooi, S. K. (2016). *Climate change reporting in Malaysia: Application of institutional theory and resource-based view* [Doctoral thesis, University Sains, Malaysia]. http://eprints.usm.my/31651/1/Ooi_Say_Keat_PhD_2016.pdf
- Peng, J., Sun, J., & Luo, R. (2015). Corporate voluntary carbon information disclosure: Evidence from China's listed companies. *World Economy*, 38(1), 91–109. <https://doi.org/10.1111/twec.12187>
- Pitrakkos, P., & Maroun, W. (2020). Evaluating the quality of carbon disclosures. *Sustainability Accounting, Management and Policy Journal*, 11(3), 553–589. <https://doi.org/10.1108/SAMPJ-03-2018-0081>
- Saha, A. K., Al-Shaer, H., Dixon, R., & Demirag, I. (2021). Determinants of carbon emission disclosures and unsustainable development goals: The case of UK higher education institutions. *Australian Accounting Review*, 31(2), 79–107. <https://doi.org/10.1111/auar.12324>
- Salehi, M., & Shirazi, M. (2016). Audit committee impact on the quality of financial reporting and disclosure: Evidence from the Tehran Stock Exchange. *Management Research Review*, 39(12), 1639–1662. <https://doi.org/10.1108/MRR-09-2015-0198>
- Salleh, Z., Seno, R., Motlak Alodat, A. Y. M., & Hashim, H. A. (2022). Does the audit committee's effectiveness influence the reporting practice of Ghg emissions in Malaysia? *Journal of Sustainability Science and Management*, 17(1), 204–220. <https://doi.org/10.46754/jssm.2022.01.014>
- Saraswati, E., Puspita, N. R., & Sagitaputri, A. (2021). Do firm and board characteristics affect carbon emission disclosures? *International Journal of Energy Economics and Policy*, 11(3), 14–19. <https://doi.org/10.32479/ijeep.10792>
- Schiemann, F., & Sakhel, A. (2019). Carbon disclosure, contextual factors, and information asymmetry: The case of physical risk reporting. *European Accounting Review*, 28(4), 791–818. <https://doi.org/10.1080/09638180.2018.1534600>
- Shehri, T. A., Braun, J. F., Howarth, N., Lanza, A., & Luomi, M. (2022). Saudi Arabia's climate change policy and the circular carbon economy approach. *Climate Policy*, 1–17. <https://doi.org/10.1080/14693062.2022.2070118>
- Stanny, E. (2013). Voluntary disclosures of emissions by US firms. *Business Strategy and the Environment*, 22(3), 145–158. <https://doi.org/10.1002/bse.1732>
- Tan, D., Bilal, Gao, S., & Komal, B. (2020). Impact of carbon emission trading system participation and level of internal control on the quality of carbon emission disclosures: Insights from Chinese State-Owned Electricity Companies. *Sustainability*, 12(5), 1–14. <https://doi.org/10.3390/su12051788>
- Thu, T., Do, H., Lan, T., Nguyen, A., Hoai, T., & Nguyen, P. (2022). Impacts of climate change and financial support on household livelihoods: Evidence from the northwest subregion of Vietnam. *Journal of Asian Finance, Economics, and Banking*, 09(6), 115–126. <https://doi.org/10.13106/jafeb.2022.vol9.no6.0115>
- Yan, H., Li, X., Huang, Y., & Li, Y. (2020). The impact of the consistency of carbon performance and carbon information disclosure on enterprise value. *Finance Research Letters*, 37. <https://doi.org/10.1016/j.frl.2020.101680>
- Zang, F., Chu, S., Gerasopoulos, K., Culver, J. N., & Ghodssi, R. (2015). Rapid fabrication of supercapacitor electrodes using bionanoscaffolds in capillary microfluidics. *Journal of Physics: Conference Series*, 660(1), 20101. <https://doi.org/10.1088/1742-6596/660/1/012010>