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Exploring the Influence of Carbon Emissions on Sustainable Development

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Abstract

This study explores the theoretical foundations of accounting practices related to carbon emissions, particularly focusing on their influence on sustainability. The research employs a questionnaire, distributed to approximately 150 managers, to gather insights into how carbon emissions are accounted for and their impact on sustainable development. The findings reveal that accounting for carbon emissions significantly affects the three pillars of sustainability—economic, social, and environmental—though with varying degrees of influence across these dimensions. The results indicate that carbon emissions accounting has a statistically significant impact on the economic and environmental aspects of sustainable development. In terms of the economic pillar, companies that account for their carbon emissions are more likely to engage in practices that mitigate environmental harm while maintaining or improving their financial performance. This is due to the growing recognition that addressing environmental sustainability can lead to cost savings (e.g., through energy efficiency) and enhanced corporate reputation, which in turn drives economic value. Regarding the environmental pillar, the study highlights that accounting for carbon emissions is crucial for reducing a company's environmental footprint. Firms that systematically track and report their emissions are better positioned to implement strategies for emissions reduction, thereby contributing to global climate goals. However, the social aspect of sustainability appears to be less affected by carbon emissions accounting. The study finds no significant correlation between accounting for carbon emissions and improvements in social sustainability, such as labor rights or community engagement. Moreover, the study underscores the role of large corporations in achieving environmental sustainability. By accounting for their carbon emissions, these companies become more aware of their environmental responsibilities. The research suggests that failing to adopt labor and human rights standards, alongside environmental measures, could lead to reputational risks and accountability, potentially affecting the company's long-term viability. Therefore, while the economic and environmental dimensions of sustainability are directly influenced by carbon emissions accounting, the social component remains less impacted in the current business context.

Keywords: Carbon Emissions, Sustainability, Environmental Impact, Economic Performance
JEL Codes: Q56, M41, Q51

1. INTRODUCTION

At the end of the 20th century, researchers started to focus on the growing problems and harmful effects caused by climate change, particularly in the wake of the Industrial Revolution. The rapid industrialization that accompanied this period, driven largely by factories and large corporations, led to a significant increase in air pollution and the emission of greenhouse gases. This, in turn, contributed to global climate change, which has since become one of the most pressing challenges facing the planet. Climate change refers to long-term shifts in weather patterns and temperatures that deviate from historical norms. Key examples of these shifts include alterations in precipitation patterns, such as more frequent or intense storms, and rising average global temperatures (Khan & Hassan, 2019; Petrakis, 2021; Porro & Gia, 2021). One of the most visible impacts of climate change is the accelerated melting of glaciers and ice sheets, leading to rising sea levels. The warming of the Earth has also resulted in more extreme weather events, such as heatwaves, droughts, and flooding, disrupting ecosystems, agriculture, and human livelihoods. These changes in the climate are not isolated but are interconnected with human activities, especially those linked to the burning of fossil fuels, deforestation, and industrial activities. The release of carbon dioxide (CO2) and other greenhouse gases from factories, transportation, and energy production has been identified as a primary driver of the observed climate changes. As global temperatures rise, the consequences for ecosystems, biodiversity, and human societies become increasingly severe, prompting calls for urgent action to mitigate and adapt to these changes. Addressing the causes and effects of climate change has become a central focus for researchers, policymakers, and businesses alike, all of whom are seeking solutions to reduce emissions, enhance sustainability, and promote environmental stewardship (Luna & Luna, 2018; William & Adam, 2018).

Scientific and professional accountants, who play a crucial role in the issuance of accounting standards, face significant challenges when determining how to measure the harm caused by climate change. As the impacts of climate change become increasingly evident, there is growing global interest in understanding how it affects businesses and financial systems. One of the key concerns is how companies and investors will respond to, and remain resilient against, climate-related risks.

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Climate change is no longer seen as a distant issue, but one that could have direct financial repercussions for companies unable to adapt or achieve sustainability goals (Ali et al., 2021). Accountants are at the forefront of addressing these challenges because accounting plays a critical role in the integration, standardization, and assessment of climate-related data. As businesses and investors recognize the financial risks associated with climate change, they need accurate and consistent reporting to understand how these risks may affect financial stability and sustainability (Ahmad & Ali, 2019; Durbin & Filer, 2021). This is where the role of accounting standards becomes increasingly important. By establishing frameworks to measure and report on the environmental impacts of corporate operations, accountants ensure that businesses can assess the true financial costs of climate change, including the cost of carbon emissions, energy consumption, and other sustainability-related factors (Zhang, 2021; Diaz & Weber, 2020). One of the key tasks in this process is determining how to account for carbon emissions. While many companies are increasingly aware of the importance of reducing their carbon footprint, accounting for carbon emissions and other environmental factors in a meaningful way remains complex. Standardized approaches to measuring and reporting carbon emissions are still evolving, but they are essential for companies to gain an accurate understanding of their environmental impact (Lin, 2021; Ali & Audi, 2016). Without clear guidelines and effective reporting mechanisms, companies may struggle to assess their exposure to climate-related risks or understand the potential financial consequences of their carbon emissions. The International Federation of Accountants (IFAC) (2021) emphasizes that accounting for climate change impacts is essential for ensuring the sustainability of businesses. By incorporating climate risks into financial reporting and integrating sustainability into everyday business practices, accountants can help companies identify opportunities for reducing emissions, enhancing resource efficiency, and improving long-term financial performance. However, many accountants still face difficulties in understanding the complexities of how to account for carbon emissions and other environmental factors. Therefore, providing the necessary education, resources, and guidance on sustainability accounting is crucial for enabling accountants to help companies navigate these challenges and contribute to a more sustainable global economy. Because it is impossible to manage what cannot be measured, gathering and converting relevant data into actionable information is essential for effective decision-making, particularly in the context of sustainability and climate change. As Evan et al. (2021) emphasize, the ability to quantify and assess the environmental impacts of business activities, such as carbon emissions, is critical for managing and mitigating risks associated with climate change. Without clear, reliable data, organizations cannot accurately measure their environmental footprint, identify areas for improvement, or make informed decisions about their sustainability efforts.

The process of transforming raw data into measurable and meaningful information involves several steps. First, organizations need to collect comprehensive and accurate data related to carbon emissions, energy consumption, waste management, and other environmental factors. This data must then be organized and analyzed to understand its significance, potential risks, and impact on the business. The next step is to integrate this information into financial reporting frameworks, ensuring that it aligns with existing accounting standards and regulatory requirements. This allows companies to assess not only their environmental performance but also the financial implications of their sustainability practices. For accountants and financial professionals, this means developing new skills and tools to handle environmental data. The ability to quantify carbon emissions and other climate-related risks requires a combination of technical expertise, regulatory knowledge, and the use of specialized software and models. Moreover, as the demand for transparency in sustainability reporting grows, businesses must ensure that the data they report is accurate, consistent, and comparable across time periods and industries. Ultimately, the goal is to empower businesses with the information needed to make informed decisions that support long-term sustainability. Whether through reducing carbon footprints, improving resource efficiency, or mitigating climate-related risks, effective measurement and management of environmental data is a key component of achieving sustainability goals. By ensuring that businesses can measure their environmental impact, accountants help create a foundation for responsible business practices that align with both financial performance and environmental stewardship.

Accounting for carbon emissions resulting from climate change is a critical first step towards reducing emissions and demonstrating their broader impact on a company's sustainability. This process enables businesses to measure their environmental footprint and understand how their operations affect the environment, which in turn helps them plan for mitigation strategies. The importance of accounting for these emissions lies in its ability to integrate environmental concerns into the financial decision-making processes of companies. By systematically assessing carbon emissions, businesses can not only comply with regulations but also align with global sustainability goals, like those outlined in international agreements on climate change. The three pillars of sustainability—economic, social, and environmental—serve as the foundation for evaluating how carbon emissions are accounted for in financial statements. Each of these pillars offers a distinct perspective on the broader implications of carbon emissions, which companies must consider as they report their sustainability efforts. The environmental pillar is directly linked to the impact of carbon emissions on the planet. By accounting for emissions, companies can track their environmental footprint, identify areas for improvement, and take action to reduce their carbon output. Accurate carbon accounting is essential for companies that wish to meet sustainability targets, comply with environmental regulations, and contribute to global efforts like the Paris Agreement. It helps ensure that businesses are part of the solution to climate change rather than contributing to its exacerbation.

The economic pillar focuses on the financial impact that carbon emissions have on a business. This includes both direct and indirect costs associated with reducing emissions, such as investing in cleaner technologies, adopting renewable energy sources, or paying carbon taxes. Additionally, companies that do not manage their carbon footprint effectively may face financial risks, including reduced access to capital, higher operational costs, or damage to their reputation, all of which can

affect long-term financial performance. Investors are increasingly factoring environmental performance into their decision-making, meaning that carbon accounting can have a significant impact on a company's market value and financial prospects. The social pillar considers the wider social consequences of carbon emissions, particularly how companies' actions affect local communities, workers, and consumers. Companies that fail to account for their emissions may face reputational damage, loss of consumer trust, or increased public scrutiny. Additionally, businesses are being held more accountable for their role in global sustainability, including issues related to labor practices and human rights. If a company's operations contribute to climate change, it may face social backlash, legal challenges, or loss of market share. Accounting for carbon emissions through a framework that includes the social aspect of sustainability enables companies to address these concerns proactively. Incorporating carbon accounting into financial reporting not only supports environmental and social objectives but also has important implications for a company's financial statements. International accounting standards, such as those set by the International Accounting Standards Board (IASB), require businesses to disclose environmental risks, including the impact of carbon emissions and climate-related factors on their financial performance. This includes integrating carbon emissions data into various aspects of financial reporting, such as asset valuations, provisions for environmental liabilities, and future earnings projections. Carbon emissions can affect a company's financial standing in various ways. For example, businesses that do not account for the future costs of carbon taxes or penalties may understate their liabilities. Similarly, a company that fails to disclose the risks associated with climate change may present an overly optimistic picture of its financial health. Investors, regulators, and stakeholders need accurate and transparent financial reports to assess the risks associated with climate change. If carbon emissions and related environmental factors are not adequately reflected in financial statements, the company could face legal, regulatory, and reputational consequences that ultimately affect its bottom line. To meet international accounting standards, businesses must ensure they accurately measure and report their carbon emissions, following established frameworks and methodologies. This may involve adopting reporting frameworks like the Greenhouse Gas Protocol or adhering to recommendations from the Task Force on Climate-related Financial Disclosures (TCFD). Companies must also disclose the financial risks posed by climate change, including the impact of carbon taxes, changes in regulatory policies, or shifts in consumer demand for environmentally sustainable products.

Accounting for carbon emissions is an essential step for businesses aiming to achieve long-term sustainability. By integrating the three pillars of sustainability—economic, social, and environmental—into their carbon accounting processes, companies can enhance their financial and reputational standing while contributing to global climate goals. Effective carbon accounting not only helps businesses reduce their environmental impact but also strengthens their financial performance by addressing climate-related risks and opportunities. With the right systems in place, companies can improve transparency, reduce exposure to climate risks, and position themselves as leaders in the transition to a more sustainable global economy. The success of institutions is associated with their ability to maintain sustainability. Through environmental adaptation and protection against pollution and the hazards of climate change.

2. LITERATURE REVIEW

One of the most significant effects of global warming is climate change, particularly the rise in temperatures. This increase in temperature has a direct impact on weather patterns, making them more erratic and extreme. For instance, higher temperatures can alter air movement, resulting in sporadic weather phenomena such as more frequent and intense storms, droughts, and heatwaves. As the planet warms, these unpredictable changes in weather can cause significant disruptions in ecosystems, agriculture, and even human health. Human activities, particularly since the start of the Industrial Revolution, have been the primary driver of climate change and the rise in Earth's temperature. The burning of fossil fuels like coal, oil, and natural gas has led to an increased release of carbon dioxide (CO2) and other greenhouse gases into the atmosphere. This process occurs when carbon-based fuels react with oxygen in the atmosphere, releasing CO2, which traps heat and contributes to the greenhouse effect. Over the past 50 years, industrialization, urbanization, and deforestation have accelerated the concentration of CO2, significantly impacting the planet's climate. As more CO2 and other greenhouse gases accumulate, they enhance the natural greenhouse effect, leading to a warming of the Earth's surface. This warming is not just a gradual rise in temperature; it triggers a complex array of changes in the climate system. These include shifting weather patterns, rising sea levels due to melting glaciers and ice sheets, and disruptions to biodiversity and ecosystems. Consequently, the combination of these changes leads to more severe environmental and economic challenges worldwide. Accounting for carbon emissions has become one of the most critical challenges in the global business landscape. With growing concerns about climate change, organizations and regulatory bodies have recognized the need to accurately measure, report, and manage carbon emissions to help mitigate their environmental impact. In response to this, key accounting bodies such as the American Accounting Standards Board and the International Accounting Standards Board (IASB) have initiated efforts to develop consistent and reliable frameworks for carbon emissions measurement.

In 2010, the FASB launched a cooperative study to explore the implications of carbon emissions accounting for financial reporting. The primary aim was to develop accounting standards that would allow companies to effectively quantify their carbon footprints and understand the financial implications of their emissions. In parallel, the IASB also began its efforts to align global accounting practices with the growing demand for sustainability disclosures, recognizing that companies' environmental performance can significantly influence their financial position and future prospects. Both boards acknowledged that accounting for carbon emissions is not just a matter of tracking numbers but also involves understanding how these emissions affect long-term business sustainability. The challenge lies in integrating environmental costs, such as

carbon taxes, emissions trading, and the potential for regulatory changes, into the financial statements of companies. These standards aim to provide transparency, helping stakeholders—investors, consumers, and regulators—assess the risks associated with carbon emissions and the strategies companies are adopting to reduce their environmental impact.

Incorporating carbon emissions into financial accounting is an essential step in aligning business practices with global sustainability goals and addressing the financial risks posed by climate change. This also encourages companies to adopt more sustainable practices and consider the long-term environmental consequences of their operations. Ibrahim (2020) argued that the international standard IAS 37 defines a constructive obligation as an obligation arising from a binding event based on the entity's conduct. Specifically, it refers to situations where an entity's actions, policies, or established practices create a valid expectation among others that it will carry out certain responsibilities. In the context of carbon emissions, this would involve an entity acknowledging its responsibility to mitigate the environmental impacts of its activities, particularly emissions. According to the standard, when a company engages in activities that result in emissions—such as the burning of fossil fuels—it creates an implicit obligation to address the environmental consequences of those activities. The facility's conduct, including its policies, practices, and public commitments, can give rise to an expectation that it will reduce or offset its carbon emissions. As a result, the company must recognize and allocate resources to address this obligation, often in the form of carbon credits or quotas, in line with regulatory requirements. Thus, under IAS 37, companies are required to recognize their obligation to reduce emissions if it is clear that such an expectation exists, and the company has publicly committed to taking action to meet its environmental responsibilities. This recognition of a constructive obligation helps ensure that the company remains accountable for its emissions and the associated costs, encouraging proactive measures for sustainability. This accounting framework emphasizes the importance of acknowledging not only the direct financial liabilities but also the environmental impact and responsibilities linked to a company's operations, aligning financial reporting with sustainability goals.

Accounting for carbon emissions involves tracking and categorizing all greenhouse gases, with a particular focus on carbon dioxide. These emissions are typically classified into two categories: direct emissions and indirect emissions. Direct emissions come from the use of a company's property, such as those generated by the burning of fossil fuels in company-owned machinery, vehicles, or facilities. Indirect emissions, on the other hand, arise from activities like electricity generation, steam, heating, cooling, or the transportation of goods to other locations for trade. In their study, Roberts and Karthak (2021) employed a multidisciplinary approach, combining chemistry, engineering, and cost accounting, to develop guidelines for accounting for carbon emissions and identifying the responsible parties. The researchers broke down carbon emissions into specific outputs, aiming to create a system that could effectively assign responsibility for emissions at a more granular level. This type of detailed accounting could be valuable for policy development, such as carbon taxation.

Their findings suggest that such a carbon accounting system could enable governments to implement more targeted fiscal policies. For instance, entities that produce a disproportionate amount of carbon emissions could be subject to higher taxes, incentivizing them to reduce their carbon footprint. Conversely, companies that produce fewer emissions could benefit from lower taxes, rewarding their efforts in sustainability. The study applied this framework to a company manufacturing car doors, illustrating how accounting for emissions could be integrated into business practices and regulatory systems to help mitigate the overall environmental impact. This approach underscores the role of accounting in achieving sustainability goals and supporting a more equitable approach to environmental taxation and policy. This study aimed to explore the growing body of accounting literature regarding the impact of climate change on financial reporting. Carmela et al. (2020) applied mathematical and statistical methods, utilizing scientific map analysis tools to review books and academic theses related to the topic. Their findings revealed a strong and clear relationship between climate change and sustainable development, suggesting that accounting plays a critical role in understanding and reporting the effects of climate change on financial outcomes.

The study emphasized the importance of incorporating climate change considerations into financial statements, especially as they relate to sustainability. It highlighted that businesses, especially in sectors heavily impacted by climate change, need to account for the potential costs and opportunities related to environmental risks. Furthermore, the research pointed to the significant role of renewable energy in achieving a healthier climate, underscoring the need for businesses to transition towards sustainable energy sources. Carmela et al.'s work contributes to the growing recognition of the importance of sustainability in financial reporting, advocating for better integration of climate-related factors into corporate financial disclosures. It calls for more precise and transparent accounting practices that reflect the economic and environmental implications of climate change, which could, in turn, support the broader goals of sustainable development and environmental protection. Praveen and Mohammed (2020) investigated the disclosure processes for financial statements and the reporting of carbon emissions. Their study focused on how businesses incorporate carbon balances into their financial reports, particularly in terms of accounting procedures related to the establishment, measurement, presentation, and declaration of emissions stock. The authors found significant gaps in the transparency of emissions reporting among businesses. According to their findings, a large proportion of companies, 91.60%, do not disclose the methods they use to determine the stock of their emissions allowances, which raises concerns about the consistency and reliability of emissions data in financial statements.

Moreover, the study revealed that 40.46% of companies classify provisions for reducing carbon emissions as "other revenue." This classification practice can lead to confusion or misrepresentation of the actual financial impact of carbon-related liabilities and efforts to reduce emissions. By categorizing such provisions in this way, businesses might obscure the true

costs and responsibilities associated with their carbon emissions reduction strategies. Praveen and Mohammed's research highlights the need for greater clarity and standardized accounting practices in emissions reporting. Their findings suggest that companies need to adopt more transparent and consistent methods for accounting for carbon emissions, which would enable better decision-making by investors, regulators, and other stakeholders concerned with environmental sustainability and the financial implications of climate change. Ahmed's (2020) study provides a detailed examination of the financial implications of accounting for greenhouse gas emissions and their impact on corporate profitability. It highlights that while the environmental concerns of carbon emissions are widely recognized, their financial ramifications are often overlooked in corporate financial statements. The analysis emphasizes the necessity for companies to integrate the measurement of carbon emissions, their associated revenues, expenditures, and obligations into their financial accounting processes, as the costs linked to these emissions can significantly affect a company's bottom line. One of the primary findings of the study is that businesses cannot afford to disregard the financial impact of carbon emissions on their profitability. Carbon emissions incur direct costs for companies, such as the need to purchase carbon emission allowances or rights. These costs can add up quickly, especially for businesses that operate in industries with high emissions, such as manufacturing, energy, and transportation. The purchase of carbon emission rights is a key strategy for compliance with environmental regulations, but it also represents a financial burden. For instance, if a company exceeds its allocated carbon quota, it may need to buy additional carbon allowances on the open market, which can be costly. These costs are not always directly visible in profit and loss statements, but their impact on the financial health of the business is substantial.

In this context, the study stresses the importance of weighing the costs and benefits of carbon emission management. Companies must consider both the direct financial costs of acquiring carbon credits and allowances and the indirect costs associated with potential penalties, reputational risks, and the long-term impacts of non-compliance with environmental regulations. Ahmed argues that businesses must account for these costs accurately and plan for them in their financial strategies. For many companies, the price of carbon credits and allowances is a significant line item in their operational costs, and effective management of emissions can have a direct impact on profitability. Additionally, the study explores the role of carbon credits in managing emissions. Carbon credits allow companies to offset their emissions by investing in environmental projects or purchasing credits from organizations that are working to reduce greenhouse gases. These credits can be used to balance out emissions produced by the company, and while the purchase of carbon credits involves a financial outlay, it may also represent a more cost-effective approach to compliance compared to investing in technological upgrades or altering operational processes. For businesses that may not be able to reduce their emissions through internal measures alone, carbon credits offer a way to meet regulatory targets while potentially saving on other costs.

Another crucial aspect of the study is its focus on how businesses can account for both the expenses and potential revenue generated from these emission-related activities. By properly accounting for carbon emissions, companies can ensure they are prepared for any future regulatory changes or market shifts related to environmental policies. For example, as countries tighten their climate regulations or as the global market for carbon credits expands, businesses that are already well-versed in accounting for emissions will be better positioned to respond to these changes without disrupting their operations or financial performance. Ahmed's findings also suggest that integrating carbon accounting into financial statements is not just a matter of regulatory compliance; it can also be a strategic advantage. Companies that manage their emissions effectively may be able to lower their costs, enhance their corporate reputation, and reduce their exposure to climate-related financial risks. Conversely, failing to account for emissions or underestimating their financial impact could result in significant unforeseen expenses or legal challenges.

The study also touches on the importance of transparent and standardized accounting methods for carbon emissions, highlighting the role of international accounting standards in ensuring consistency and comparability across companies and industries. The adoption of clear guidelines and standards, such as those proposed by organizations like the International Financial Reporting Standards (IFRS) or the Global Reporting Initiative (GRI), would allow investors, stakeholders, and regulatory bodies to more easily assess a company's environmental impact and its management of carbon-related financial risks. Ahmed's study underscores the growing significance of carbon emission costs in the financial landscape. With climate change becoming an ever-more pressing global issue, businesses must understand the financial implications of their emissions and incorporate carbon accounting into their financial reporting. By doing so, they can mitigate risks, optimize costs, and contribute to global sustainability efforts. In the long term, companies that prioritize accounting for carbon emissions and integrate this aspect into their strategic planning will not only comply with environmental regulations but also position themselves as leaders in the transition to a more sustainable, low-carbon economy.

Ibrahim (2020) conducted an analytical review of the rules and measurement practices concerning assets and liabilities within the framework of the International Accounting Standards Board (IASB). The study was particularly focused on assessing how these established rules could be applied to rights and claims arising from trading operations related to greenhouse gas emissions. Ibrahim's research sought to bridge the gap between the existing accounting standards and the emerging need to incorporate climate change-related factors, such as carbon emissions, into financial accounting practices. The researcher highlighted the challenges of adapting the conceptual framework of IASB to the new and rapidly evolving field of environmental accounting. Traditionally, the accounting profession has focused on the valuation and reporting of physical and financial assets, but the rise of climate change concerns has prompted a need to rethink how intangible assets, such as emission rights, should be measured and reported. Ibrahim pointed out that greenhouse gas emissions, particularly carbon credits and allowances, present unique challenges for financial reporting, as they are both a regulatory asset and an

environmental liability. The concept of "carbon assets" and "carbon liabilities" is still relatively new within the traditional accounting framework, but it is increasingly important in light of global efforts to address climate change. In his study, Ibrahim proposed a model for the accounting treatment of emissions related to greenhouse gases, aiming to create a standardized approach that could be integrated into the broader framework of IASB. The proposed model takes into consideration various facets of carbon emissions, including the initial allocation of emission allowances, the trading of carbon credits, and the obligations of companies to reduce their carbon footprint. The model also incorporates the necessity for companies to recognize the environmental impact of their operations, in addition to their financial performance. One of the key points in Ibrahim's proposed model is the need to account for emission allowances as intangible assets. These assets arise when a company receives, purchases, or is allocated carbon credits or emission quotas. According to Ibrahim, these allowances should be recognized on the balance sheet as assets at their fair value, which could fluctuate depending on market conditions. For instance, if carbon credits are traded in a market, their price could vary, and the company would need to adjust the valuation of these credits accordingly. Similarly, companies would also be required to recognize liabilities when they fail to meet their emission reduction targets and face penalties or additional costs for purchasing additional credits. The study emphasized that, just as with traditional financial assets, the measurement of carbon credits and emissions-related liabilities must be based on verifiable, market-driven information. Ibrahim also addressed the complexity of applying existing accounting standards to environmental issues. Under the IASB framework, financial instruments like carbon allowances would need to be reported in accordance with the guidance on financial instruments, which involves determining fair value, potential impairments, and changes in the value of these instruments. Additionally, Ibrahim acknowledged the broader implications of carbon accounting for corporate financial statements. The integration of carbon emissions into financial accounting goes beyond mere regulatory compliance; it influences a company's overall financial health, investment decisions, and long-term sustainability. Accounting for carbon emissions allows businesses to make informed decisions about their environmental practices and the costs associated with carbon reduction efforts. By including emission rights and obligations in their financial reports, companies are not only complying with environmental regulations but are also creating transparency for investors, regulators, and other stakeholders who are increasingly concerned about environmental risks and sustainability.

Ibrahim's work also examined the suitability of IASB's conceptual framework for the evolving needs of environmental accounting. He proposed that the framework might need to evolve to better address the challenges posed by climate change and carbon emissions, suggesting that the IASB could issue specific guidelines on accounting for carbon emissions in the near future. Such guidelines would help companies more effectively account for the economic impact of their carbon footprint and enhance the comparability of financial statements across industries, especially for those industries that are more heavily involved in carbon emissions, such as energy, transportation, and manufacturing. Ibrahim's study provides an important contribution to the field of environmental accounting, especially as the financial sector begins to acknowledge the significant impact of climate change on businesses. The proposed model for accounting carbon emissions offers a way forward for companies seeking to integrate climate-related risks and obligations into their financial statements. By applying the rules and measurement concepts from the IASB to carbon emissions and related trading operations, companies can better manage their environmental responsibilities while maintaining financial transparency. This could ultimately help businesses navigate the challenges of transitioning to a more sustainable and low-carbon economy while aligning their accounting practices with global climate change objectives.

Elmalah (2018) conducted a study to investigate the relationship between voluntarily disclosing carbon emissions and a company's financial performance. The research was applied to nine companies listed on the Egyptian Stock Exchange, covering five key industries: chemicals, financial services, construction materials, gas and oil, and primary resources. The study aimed to explore how voluntary transparency regarding carbon emissions affects companies' financial outcomes and whether companies that disclose more information about their environmental impact perform differently in financial terms.

The findings of Elmalah's research revealed a positive correlation between the level of voluntary disclosure of greenhouse gas emissions and the financial performance of the companies involved. This suggests that companies that are more transparent about their carbon emissions tend to experience better financial outcomes, potentially due to increased investor confidence, enhanced reputation, and stronger stakeholder relationships. The study highlights the growing importance of environmental, social, and governance (ESG) factors in the corporate world, particularly with respect to how businesses manage and report their environmental impact.

Elmalah's results align with the broader trend seen in many markets, where investors and consumers are becoming increasingly aware of and concerned about the environmental impact of businesses. Companies that disclose their carbon emissions and demonstrate efforts to reduce their environmental footprint may be seen as more responsible, sustainable, and future-oriented. This, in turn, could lead to improved financial performance through increased customer loyalty, improved access to capital, and a more favorable public image. In contrast, companies that are less transparent about their carbon emissions or fail to take action to address climate-related risks may face reputational damage or increased scrutiny from regulators and investors. The study also points to the potential benefits of voluntary disclosure beyond regulatory requirements. While many countries now have mandatory reporting standards for carbon emissions, voluntary disclosure allows companies to go beyond the minimum legal requirements and demonstrate a proactive approach to sustainability. Companies that voluntarily disclose their carbon emissions are often seen as leaders in environmental responsibility, which can positively affect their brand, customer trust, and ultimately, their financial performance. Moreover, the disclosure of

greenhouse gas emissions allows investors to better assess the environmental risks and opportunities associated with a company, providing a clearer picture of long-term sustainability.

Elmalah's study provides valuable insights into the relationship between environmental transparency and financial performance. It underscores the importance of voluntary disclosure in the context of carbon emissions and suggests that companies that actively disclose their environmental impact may not only contribute to the fight against climate change but also enjoy enhanced financial performance. This finding is particularly relevant for policymakers, investors, and businesses as they continue to navigate the challenges of integrating environmental factors into corporate decision-making and reporting. By embracing transparency and taking steps to reduce their carbon emissions, companies can position themselves as responsible corporate citizens, aligning financial success with sustainable development goals.

3. METHODOLOGY

The study focused on a sample of 150 randomly selected mid-level managers in Saudi Arabia. These managers were chosen because they were college graduates proficient in English, making them suitable participants for the study. Additionally, mid-level managers were selected due to their ability to provide informed and honest opinions without much hesitation, which helped ensure the quality and relevance of the responses. The sample population comprised managers from various industries, and their ages ranged from 30 to 50 years, reflecting a group with significant professional experience. From the original 150 managers surveyed, 120 completed the questionnaires, providing a response rate of 80%. This high response rate indicates strong engagement and interest among the participants in the subject of the study. The data collected were then subjected to a series of statistical analysis methods appropriate to the study's objectives and hypotheses. The researchers utilized SPSS (Statistical Package for the Social Sciences) software to perform the necessary analyses, allowing them to efficiently process and interpret the data. The statistical analysis involved tabulating the responses and applying various techniques to test the validity of the hypotheses, ensuring that the results were both reliable and meaningful. This approach allowed the researchers to gain insights into the managers' perspectives on the subject matter and to draw conclusions based on solid empirical evidence. The data analysis process was designed to be rigorous and comprehensive, taking into account the study's objectives and the nature of the variables involved.

By employing these methods, the researchers aimed to gain a deeper understanding of the attitudes and behaviors of mid-level managers in Saudi Arabia, particularly in relation to the topic being investigated. The results of this analysis were crucial for drawing conclusions about the broader implications of the study, contributing valuable knowledge to the field of research on managerial behavior, decision-making, and organizational practices in the context of Saudi Arabia.

4. RESULTS AND DISCUSSION

The table 1 presents the results of the analysis of variance (ANOVA) for multiple regression models. ANOVA is used to determine whether there is a statistically significant relationship between the dependent variable and the independent variables included in the model. For the first model, the total sum of squares is 242.57, with a regression sum of squares of 178.02 and a residual sum of squares of 64.548. The mean square for regression is 178.02, and the F-statistic is 325.43, which is highly significant with a p-value of 0.000. This suggests that the independent variables in this model explain a significant amount of the variance in the dependent variable. The model is overall highly effective in capturing the relationship between the variables. In the second model, the total sum of squares is 63.355, with a regression sum of squares of 47.501 and a residual sum of squares of 15.854. The mean square for regression is 47.501, and the F-statistic is not provided for comparison, but the significance is noted as 0.000. This indicates that this model also explains a significant portion of the variance in the dependent variable, and the relationship between the variables is statistically significant.

The third model shows much smaller results. The total sum of squares is 16.325, with a regression sum of squares of 0.144 and a residual sum of squares of 16.181. The mean square for regression is 0.144, and the F-statistic is 1.049, which is not statistically significant with a p-value of 0.308. This suggests that the model does not adequately explain the variance in the dependent variable, and the independent variables are not significantly related to the dependent variable in this case. Finally, in the fourth model, the total sum of squares is 48.212, with a regression sum of squares of 36.857 and a residual sum of squares of 11.355. The mean square for regression is 36.857, and the F-statistic is 383, which is highly significant with a p-value of 0.000. This indicates that this model explains a substantial portion of the variance in the dependent variable, and the relationship between the independent variables and the dependent variable is statistically significant. The first, second, and fourth models show strong statistical significance, with the regression sums of squares explaining a large portion of the total variance. The third model, however, does not perform well, as the F-statistic is not significant, indicating that the independent variables do not significantly explain the dependent variable.

The table 2 presents the regression outcomes for four different models, including coefficients, t-statistics, and significance values for both the constant and the variable. The coefficients reflect the estimated values for the constant and the variable, the t-statistics show how significantly different these coefficients are from zero, and the significance values (p-values) indicate whether these results are statistically significant. In the first model, the constant term has a coefficient of 0.857, and the variable has a coefficient of 18.04. Both coefficients are highly significant, with t-statistics of 17.778 for the constant and 18.04 for the variable, both having p-values of 0.000. This indicates that both the constant and the variable have a statistically significant effect on the dependent variable, with the variable having a large and highly significant impact. The second model shows a constant term coefficient of 0.866, with a t-statistic of 4.17 and a p-value of 0.000, indicating strong significance.

The variable in this model has a coefficient of 18.803, with a t-statistic of 19.57 and a p-value of 0.000, suggesting that it also has a very strong and statistically significant relationship with the dependent variable.

Table 1: Analysis of Variance

Model	Sum of Squares	Mean Square	F	Sig.
Regression	178.02	178.02	325.43	0.000
Residual	64.548	0.547		
Total	242.57			
			353.54	0.000
Regression	47.501	47.501		
Residual	15.854	0.134		
Total	63.355			
Regression	0.144	0.144	1.049	0.308
Residual	16.181	0.137		
Total	16.325			
Regression	36.857	36.857	383	0.000
Residual	11.355	0.096		
Total	48.212			

In the third model, the constant term has a coefficient of 0.094, and the variable has a coefficient of 1.024. The t-statistics for the constant and the variable are 24.903 and 0.308, respectively. The constant is highly significant with a p-value of 0.000, while the variable is not statistically significant with a p-value of 0.308, suggesting that the variable has little to no impact on the dependent variable in this model. Finally, in the fourth model, the constant term has a coefficient of 0.874, with a t-statistic of 7.733 and a p-value of 0.000, indicating that the constant is significant. The variable has a coefficient of 19.57, with a t-statistic of 19.57 and a p-value of 0.000, suggesting that the variable is also highly significant and plays an important role in explaining the variation in the dependent variable. In sum, the first, second, and fourth models show that both the constant and the variable are statistically significant, with the variable having a strong effect. However, in the third model, while the constant term is significant, the variable does not appear to have a significant impact on the dependent variable.

Table 2: Regression Outcomes

Model	Coefficients	t.	Sig.
Constant	0.857	17.778	0.000
Variable		18.04	0.000
Constant	0.866	4.17	0.000
Variable		18.803	0.000
Constant	0.094	24.903	0.000
Variable		1.024	0.308
Constant	0.874	7.733	0.000
Variable		19.57	0.000

5. CONCLUSIONS

This paper aims to explain the factors that must be considered when using international accounting standards to address climate change, specifically in the context of carbon emissions and their impact on financial statements. It explores the theoretical foundations of accounting for carbon emissions and their connection to sustainability. The paper emphasizes the importance of accurate and unified accounting measurements of carbon emissions, as these measurements can play a significant role in both managing and mitigating the environmental impact of businesses. By quantifying carbon emissions, companies can better control and reduce their environmental footprint, contributing to global sustainability efforts. The accurate accounting of carbon emissions and the assets and liabilities related to carbon emission shares is critical for both internal and external stakeholders. Internal parties, such as managers and financial teams, benefit from clear and precise accounting standards, which help guide operational and financial decision-making. External parties, including investors, regulators, and the public, also rely on these measurements to assess a company's environmental impact and compliance with sustainability goals. Carbon emissions from thermal activities, in particular, have a substantial effect on a company's income and overall financial statements, making it essential to integrate these considerations into financial reporting. However, despite the importance of addressing carbon emissions in accounting practices, there is currently no formal, legally enforceable standard for accounting for thermal carbon emissions. While various scientific and professional organizations have developed non-binding proposals and recommendations, these are not yet universally adopted or mandatory for businesses engaged in activities that contribute to thermal emissions. Many of the proposals and academic studies in this area

have introduced innovative approaches for calculating the cost of carbon emissions, including the use of sustainable, balanced performance measures. These measures often add a fifth dimension—environmental impact—into performance assessments, alongside the traditional financial dimensions. The lack of a universal and legally enforceable standard for accounting for carbon emissions highlights the need for greater collaboration among scientific and professional organizations. These organizations, which are experts in defining standards, must work together to establish a unified approach to measuring and reporting carbon emissions. Such a standard would not only enhance transparency but also enable businesses to more effectively manage their emissions and contribute to the global goal of reducing the environmental impact of industrial activities. By establishing clear, consistent guidelines for accounting for carbon emissions, these organizations can help ensure that businesses play a meaningful role in mitigating climate change and achieving long-term sustainability goals.

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