



Triple Pillar for Sustainability of Accounting Evaluation of Carbon Emissions and Climate Change

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ABSTRACT

This study is among the first to address the relationship between accounting and adaptation to climate change. Aramco is a well-known company in the Middle East that produces oil, and it was used as a case study. This study examines the theoretical underpinnings of accounting assessment of carbon emissions arising from climate change and their influence on sustainability. The questionnaire was distributed to approximately 150 Saudi Arabian managers. The researcher used an analytical descriptive technique and the Statistical Packages Program for Social Sciences (SPSS) to assess the sample, fill out, tabulate, analyze the data, and test the hypotheses. The findings demonstrate that accounting for carbon emissions affects sustainable development in its three pillars-economic, social, and environmental. Further, the sub-hypothesis's results indicate that accounting for carbon emissions statistically impacts sustainable development's economic and environmental aspects. Accounting for carbon emissions has no discernible impact on sustainable development through the social component. The researcher advocated that the social aspect of sustainable development should be given attention. Large corporations are made aware of their significance in achieving environmental sustainability and that failing to adopt labor and human rights standards will result in companies being held accountable.

Keywords: Carbon Emissions, Climate Change, Sustainable Development, Accounting Assessment, Aramco, Saudi Arabia

Classifications: F64, G2, M41

1. INTRODUCTION

At the end of the 20th century, researchers began to pay attention to the problems and harms created by climate change after the Industrial Revolution and the air pollution caused by factories and giant corporations. This, in turn, has had a significant impact on global climate change. Climate change refers to the change in regular climatic conditions. Examples include changes in precipitation patterns, higher-than-normal temperatures, and smaller glaciers due to ice sheets melting more quickly than usual (Waite Taryn, 2022; Anna, M.R.B.D. (2022).

Scientific and professional accountants who oversee the issuance of accounting standards face significant challenges-determining the foundations for measuring the harm caused by climate change. There is an enormous global interest in the scope of the

response and vulnerability of capital to climate crises. Investors and stakeholders view climate change as a fundamental issue that could have financial repercussions for many companies and their inability to achieve sustainability. Accounting is crucial in integrating, standardizing, and assessing data relating to the harms brought on by climate change. Therefore, paying attention to how climate change and damage are recognized in accounting to protect its sustainability and financial position (IFAC, 2021). Accountants may help companies incorporate sustainability into their daily operations by creating a plan to account for carbon emissions. However, many must understand how to account for carbon emissions in this process (Tarryn, 2022, p. 42).

Because it is impossible to manage what cannot be measured, this requires gathering a large amount of related data and converting it into information that can be measured (Evan et al., 2021, p. 53).

Accounting for carbon emissions resulting from climate change is the first step towards reducing them and demonstrating their impact on companies' sustainability.

From there, the research aims to explain the three pillars of sustainability that help assess accounting measurements for carbon emissions resulting from climate change. It also aims to identify the impact of these carbon emissions on financial statements and understand the considerations that must be taken when applying international accounting standards International Accounting Standards Board. (2018).

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. This study contributes to the existing literature by addressing the following concerns:

Does attaining sustainable development in the three pillars depend significantly on accounting for carbon emissions?

Thus, the following hypothesis was developed:

H: Accounting for carbon emissions has a statistically significant impact on attaining sustainable development for all three pillars (economic, social, and environmental).

Sub-hypotheses:

H1: Accounting for carbon emissions has a statistically significant impact on attaining sustainable development from an economic dimension.

H2: Accounting for carbon emissions has a statistically significant impact on achieving sustainable development through the social dimension.

H3: Accounting for carbon emissions has a statistically significant impact on achieving sustainable development through the environmental dimension.

The findings of this study support the principal, sub1, and sub3 hypotheses, highlighting the strong relationship between carbon emissions and sustainable development. On the other hand, it rejects the sub-hypotheses: "Accounting for carbon emissions has a statistically significant impact on achieving sustainable development through the social dimension."

The sequence of the paper is as follows: Introduction, discussion of the research problem, underlying assumptions, purpose, and significance. The second section discusses sustainability, carbon emissions, and climate change. A literature review is conducted in the third section, and an applied study is conducted in the fourth section. Finally, conclusions and suggestions are provided.

2. DISCUSSION OF CLIMATE CHANGE, CARBON EMISSIONS, AND SUSTAINABILITY

2.1. Climate Change

One of the most significant effects of global warming is climate

change, particularly an increase in temperature. This, in turn, exacerbates the issue of air pollution because the Earth's surface temperature affects how air moves, causing a variety of sporadic weather phenomena. Human activities have been the main contributor to climate change and the increase in Earth's temperature over the past 50 years. Furthermore, industrial activities of the new form of life have significantly increased the levels of greenhouse gases in the atmosphere, such as carbon dioxide, methane, and nitrogen oxide Ines, G. (2023).

Furthermore, since the start of the Industrial Revolution, humans have burned increasing amounts of fossil fuels. This caused an increase in the atmospheric concentration of carbon dioxide (CO₂), which is the product of the burning process between carbon and oxygen in the atmosphere. The removal of trees by humans that contribute to climate change includes converting large tracts of forest land to agricultural usage. Other numerous activities that contribute to global warming (Georgia, 2021) include the following:

1. Fossil fuels: Carbon dioxide and methane are gases released by burning fossil fuels, including coal, oil, wood, and natural gas. These gases trap heat in the Earth's atmosphere.
2. Clearing of forests: Since 1960, 56% of the carbon dioxide humans release into the atmosphere has been absorbed by forests, soils, and oceans. However, logging is increasing alarmingly, especially in Amazon forests. Forests act as the planet's lungs by releasing oxygen and absorbing carbon dioxide. Clearing these forests releases greenhouse gases. They remain in the atmosphere because they do not effectively absorb carbon dioxide.
3. Nitrogen fertilizers: Farmers employ fertilizers to increase agricultural output because intensive farming quickly depletes the soil's natural nutrients. However, certain fertilizers contain nitrogen, which, when oxidized to produce nitrous oxide, contributes to the warming of the Earth's atmosphere. Therefore, consuming other nitrous oxide-free fertilizers such as compost, green manure, and seaweed extracts is preferable.
4. Fluorine gases: Machinery, equipment, air coolers, and heat pumps usually release these hazardous gases. They are also used in fire extinguishers and solvents. These substances are up to 23,000 times more potent than carbon dioxide and can cause heat. Ammonia and hydrocarbons are other suggested air pumping and cooling usages.

2.2. Carbon Emission

Accounting for carbon emissions has become one of the most critical challenges on a global scale. The American Accounting Standards Board (FASB, 2010) and the International Accounting Standards Board (IASB, 2011) started a cooperative study to measure carbon emissions. Based on the trading system covering assets and liabilities of carbon emission shares, carbon was classified into three categories:

First, direct carbon emissions occur inside the company's legal bounds (combustion of transportation fuel, industrial process emissions, waste treatment emissions, and carbon emissions from gas leaks).

Second, indirect carbon emissions are produced when electrical energy is purchased and used to produce steam, heat, and electricity.

Third, carbon emissions result from engaging in external economic activity, extraction, and processing related to external transportation, traveling, distribution, recycling, carbon emissions associated with company operations, and company-sold goods like computers and smartphones (Jane, 2022; Kurniadi et al., 2024; Lestari et al., 2024).

There are various methods for measuring carbon emissions, and the researcher will explain how each method differs depending on whether these emissions are classified as stocks, financial instruments, or intangible assets. The following criteria are considered when estimating an asset's thermal carbon emissions. Each uses a particular measurement approach and can be quantified as follows:

2.2.1. Principles of accounting measurement for assets related to shares of thermal carbon emissions

The accounting measurement bases for these carbon emissions vary according to the classification of assets related to emission quotas KPMG. (2021). The most common classifications are as follows:

1. Assets related to carbon emissions shares are considered commodity stocks:

The Committee for the Interpretation of Financial Reports (IFRS, 2020) states that thermal carbon emissions from climate change are only retained for compliance and not for trading and are accounted for as commodity stocks under the International Accounting Standard (IAS2). Where their cost is (zero) for any event. The cost of purchase or the cost incurred to obtain these grants is added to it if they are received from government organizations for free, and carbon emissions are evaluated at a fair value if they are maintained for trading purposes by the international standard (IAS2).

The researcher argues that since carbon emission shares are either in use or ready to sell as raw or finished materials, they should be classified as commodity stocks rather than equities, which are difficult to classify as stocks.

2. Assets related to shares of carbon emissions as a financial instrument

The basis for accounting measurement differs when assets related to carbon emission shares are treated as a financial instrument (Jamaludin , 2019; Kyle and Noha, 2023; Ibrahim, 2020; Sharaf-Addin, 2024).

The shares of carbon emissions will be subject to the International Accounting Standard (IAS32). Any agreement that grants the company a financial asset, offset by a financial obligation, and grants its property rights is considered a financial instrument by the standard. A financial asset is a term used to describe contractual rights. This results in receiving a financial asset or cash. Assets and liabilities are exchanged according to the regulations of the entity owning the item.

The Financial Reporting Interpretation Committee (IFAS9, 2017) stated that financial assets or liabilities are recognized in the statement of financial position when the entity becomes a party to contractual requirements for a specific financial instrument for buying and selling financial instruments related to carbon emissions shares, using the transaction or settlement date as the basis for recognition and measurement.

Recognition refers to the time the facility must initially record the asset or liability in the balance sheet. Here, the asset is recognized as a fair value, considering the addition or subtraction of the cost resulting from the transactions.

For the subsequent measurement, it was stated (IFRS9, 2023) that the asset is evaluated in two ways according to the standards of the Reporting Interpretation Committee (IFRS9):

- A. Amortized cost includes financial investments in bonds, loans, and receivables kept at maturity. Two conditions must be met for a financial instrument to be evaluated at an amortized cost:
 1. Testing the business model. Here, the financial instrument is acquired to obtain its nominal value on its maturity date and not to sell it or benefit from a change in its fair value.
 2. Testing the characteristics of cash flows obtained periodically from a financial instrument.
- B. Fair value: If the financial instrument is measured later, it is at its fair value. This method is known as the fair-value option.

The Financial Regulatory Authority revealed its intention to develop new financial tools aimed at urging companies to reduce harmful carbon emissions by adopting advanced technologies to reduce carbon emissions that lead to global warming. These certificates are known as “carbon emissions certificates.”

The researcher believes that defining financial instruments as assets that can be traded, such as cash or any other type of financial instrument, is appropriate to the nature of carbon-thermal emissions shares, as asset ownership is represented through financial instruments based on rights. Property.

3. Considering assets related to carbon emissions quotas are considered intangible assets:

According to Praveen and Muhammed (2020) and Ahmed (2022), assets related to the shares of carbon emissions are considered intangible assets. They are treated in line with the International Accounting Standard (IAS 38) for accounting for intangible assets; accordingly, those emissions are evaluated. If they are evaluated at cost, the depreciation expense is considered. In the case of buying carbon emissions rights and selling them in the carbon market, the revaluation method is used. In this case, the assets for carbon emissions shares will be recorded at their fair value, with the profit margin recognized. The resulting revaluation in the balance sheet and any increase or surplus from the revaluation must be recognized as other comprehensive income in the statement of comprehensive income.

Considering what was stated earlier, the researcher believes it is preferable to categorize shares of carbon emissions as intangible assets rather than financial instruments or stocks. Owing to the nature of the asset, it is amortized using the straight-line technique and does not depreciate. The cost of an asset depreciates over its legal or productive life, whichever is shorter, with the following exceptions: IAS 38 states that an intangible asset is only re-estimated if it depreciates as a result of the absence of a tangible physical entity, which makes amortization more difficult.

Since there are no global accounting standards for shares of thermal carbon emissions, it is challenging for investors and users of financial statements to compare companies and make decisions that may be based on multiple factors. The categorization of carbon emission quotas uses international accounting standards. As a result, the standard for inventory, financial instruments, or intangible assets is used, resulting in financial reports with different bases and challenging-to-compare cash flows. This is because there are multiple bases for accounting for assets related to the shares of thermal carbon emissions.

2.2.2. Accounting measurement requirements for shares of thermal carbon emissions:

Two instances of these requirements must be distinguished:

1. Obligations that arise when the facility produces thermal carbon emissions

Ibrahim (2020) argued that the international standard (IAS37) defines constructive obligation as the obligation arising from a binding event according to the entity's conduct. Whether the entity acknowledges to others that it bears specific responsibilities through specific policies and practices. There is a valid expectation that the facility will carry out these responsibilities, which will pollute the air because of carrying out a particular activity and the occurrence of actual emissions resulting from that activity. Therefore, the facility must undertake work allocated to those actual carbon emissions, and it must be recognized to meet its statutory obligation to provide quotas of emissions equal to actual carbon emissions.

2. Obligations that arise when an entity purchases or allocates carbon emission shares:

First, the study (Ibrahim, 2020) stated that the buyer's obligations involve accepting payment for those carbon emissions to the seller. The buyer is obligated in a contract to sell carbon emissions shares to the seller, whether immediately or under future contracts, at a price agreed upon when creating the contract. This means there is no obligation on the buyer for the carbon emissions shares on the date of purchase other than the price of the shares only.

Second, when the facility obtains the carbon emissions quotas allocated for free, it is considered a gain on the 1st day (government grant).

Praveen and Muhammed (2020) mentioned that a credit balance must be recognized on the 1st day; as soon as the assets for carbon emissions quotas appear in the statement of financial position, it must be matched by liability. This balance is considered revenue on the 1st day if issued from a government grant. Alternatively, liability if it is issued as a loan or allocation.

If the credit balance is considered a free government grant, the facility does not bear any obligation. It is measured at cost following the international standard (IAS20) for accounting for government grants. This is within the limits of the quotas specified for free, and over that, it is evaluated at the fair market value of the emission quotas, as mentioned. A study (Ibrahim, 2020) in this regard states that if the government grant is considered a non-cash asset, then the obligation corresponding to that asset is treated as

revenue or deferred income that is consumed throughout the life of the asset and is evaluated at the fair value of the non-cash asset.

Third: Obligations that arise from the establishment obtaining free carbon emissions quotas and considering them as an obligation (loan, claims, allocation)

Haseeb (2017) stated that the credit balance corresponding to carbon emissions quotas is considered an obligation (loan, claims, and allocation). Then, as soon as the facility receives those quotas from the donor, it must submit or comply with the associated obligations and return them at the end of the allocated period. s

In this case, the obligation is not linked to actual emissions; even if the facility does not produce emissions, it must return carbon emission shares to the donor.

The researcher believes that the lack of an accounting standard within international standards related to accounting for assets and liabilities for carbon emissions shares will make companies rely on personal judgment in determining the type of asset and the resulting difference in results based on determining the asset.

2.2.3. Carbon Emissions Reflection on the financial statement:

The following are some distinct viewpoints held by academics regarding the effects of climate change on the income statement and balance sheet of accounting measurements of greenhouse gas emissions:

1. How thermal carbon emissions affect the balance sheet (Osama 2023) asserts that these effects can be seen in converting buildings into environmentally sustainable buildings. Through the installation of air purification filters and the introduction of environmentally friendly products. Lauren (2022) states that the company's current responsibilities, which include carbon commitments, are anticipated to result in higher cash flows. This includes unpaid carbon taxes resulting from increased carbon emissions, long- and short-term loans from financing low-carbon projects, long-term payments corresponding to the obligation to incur environmental costs during production, and profits and losses associated with carbon. The balance sheet is generally affected by greenhouse gas emissions, as the impact appears on intangible assets, accounts receivable, cash, advance expenses, debtors, and liabilities.

2. Effect of thermal carbon emissions on the income statement because carbon emissions cause environmental harm. Greenhouse gas emissions have a direct impact on income statements. Studies have shown that greenhouse gas emissions affect organizational expenses and revenues by lowering sales and profits (Ahmed, 2020; Arafa and Mellgy, 2021). Further, the costs of mitigating carbon emissions, losses from carbon taxes, penalties imposed on carbon emissions, and the price of acquiring permanent assets-capital expenses-are bought to preserve energy and reduce carbon emissions.

A decrease in productivity or personnel shortage also influences profit and loss accounts. Additionally, an increase in maintenance

and insurance charges impacts costs. Carbon revenue, which includes government subsidies, compensation received, tax exemptions, and money from using energy-saving technologies to cleanse while reducing pollution, affects the income statement.

The researcher believes companies should be more aware of how carbon emissions affect the balance sheet and income statement. As for the costs of obtaining a clean environment and contributing to reducing emissions, they must forego some of the costs to improve the company's reputation among investors. The fact that a business considers its environmental duties while avoiding negative legal repercussions or paying fines benefits stakeholders and gives the business a competitive advantage.

2.3. Sustainable Development

The United Nations defines sustainable development as growth that meets current demands without endangering the capacity of future generations to meet their needs. "Access to food, education, and other necessities that enhance people's quality of life" (Kathryn, 2021, p. 9; Amelia, 2022, p. 18). The International Institute for Sustainable Development defines sustainability as "development that satisfies the demands of the present without jeopardizing the capacity of future generations to satisfy their own needs."

The Arab Network for Excellence and Sustainability defines it as an approach that considers current societal demands without sacrificing or interfering with the rights of current or future generations to meet their own needs.

The researcher derives the following findings about sustainable growth from those mentioned above: making the best use of the resources and opportunities available in every industry; achieving harmony between development, economic expansion, and sustainability; fulfilling the needs of the present without compromising the ability of the future to handle its own needs; and maximizing one's present level of well-being.

The United Nations Commission on International Law has set several goals for achieving sustainable development, the most significant of which are eradicating poverty and hunger, achieving food security, promoting sustainable agriculture, ensuring a healthy life, ensuring comprehensive and equitable quality education, achieving gender equality, and ensuring the availability of water and sanitation. (Bahram and Lauren, 2022: 660).

The researcher claims that because these goals serve as a guide for both the present generation and future generations, cooperation and participation from all parties in the social, economic, and environmental sectors are necessary to ensure that the right actions are taken to improve life in a sustainable way for future generations.

The three pillars of sustainable development-economic sustainability, social sustainability, and environmental sustainability-can be considered the foundation of the concept.

A. Economic Sustainability

A manufacturing system is economically sustainable if it can meet consumer demands without jeopardizing future demand.

Production, distribution, and consumption are the three basic economic activities. Since so many natural resources can be used to support and preserve human life on Earth, decisions must be made financially and with sustainability considerations.

The essential components of sustainable economic development are as follows:

- Optimal use of resources, fair income distribution, continuous access to natural resources by the individual, and addressing the effects of environmental pollution.

B. Social Sustainability

Equity, empowerment, accessibility, participation, cultural identity, and institutional stability are all part of social sustainability.

A certain kind of social structure, called social sustainability, works to reduce poverty at a social level. Meaningful lives are based on decent healthcare, education, gender equality, and global peace and stability. Sustainability requires promoting the growth of individuals, communities, and cultures. They are challenging to accomplish because, unlike biological and economic systems, where fluxes can be easily detected, the social dimension appears complex, and the dynamics could be more defined and challenging to describe.

C. Environmental Sustainability

The core emphasis of environmental sustainability is how the natural world maintains productivity and resilience to support human life. Simon (2018:759) states that environmental sustainability refers to the ecosystem's health and capacity. Individuals are envisaged to adapt within the ecosystem and retain their capacity to satisfy both present and future requirements. They make decisions that support the environment and make each person's life healthier.

Therefore, the environmental component strongly emphasizes preserving natural resources, reducing waste, and preventing environmental deterioration (Sulphey et al., 2023; Mahmood et al., 2022).

2.3.1. The relationship between accounting for carbon emissions and sustainable development

Adopting environmental health and safety standards, particularly in industrial businesses, is one of the critical goals of sustainable development. This directly affects the functioning of human resources. An essential instrument for attaining sustainability, especially environmental sustainability, is emission accounting. This entails monitoring emissions to lower or eliminate them using environmentally friendly products and raw materials, safe waste disposal methods, and trash disposal in designated landfills. The expense of these wastes and their impact on the bottom line are two factors industrial enterprises should consider while reducing their carbon emissions.

The sustainability of these companies depends on accounting for the problem of carbon emissions by publishing social reports on environmental harm, developing educational training programs on the variety of materials used and their detrimental effects on both

people and the environment, and working to find environmentally friendly substitutes.

Calculating carbon emissions involves determining how much carbon dioxide a particular person, organization, or community releases into the atmosphere due to its operation. This emission must be considered to safeguard the environment and advance sustainability.

From the Table 1, the researcher concludes that there is an integration between accounting for carbon emissions and achieving the principles of sustainable development. These principles will only be achieved to a large extent if these emissions are accounted for and managed well. Accounting measurement is the basis for managing waste and emissions, thus achieving sustainable development’s main principles.

3. LITERATURE REVIEW

Various accounting studies have dealt with accounting for damages brought on by climate change, and each study has taken a different approach to the subject.

(Osama 2023) investigated climate change and measures taken to decrease its negative consequences and determined how these changes affect management accounting. Additionally, it examines ways to quantify and disclose data on greenhouse gas emissions. Management accounting also plays a role in laying the groundwork for such disclosures. They discovered that strategic management accounting tools and procedures can help firms identify and evaluate costs associated with climate change.

(Kyle and Noha, 2023) also attempted to clarify the distinction between accounting for carbon and accounting for carbon emission gases and their divisions. They concluded that accounting only for carbon dioxide. Accounting for carbon emissions denotes the emissions of all gases, including carbon. Carbon emissions are divided into emissions issued directly from using the company’s property. Emissions from electricity generation, steam, heating, cooling, and moving to other trade destinations are indirect. To produce guidelines and ideas to minimize carbon emissions by accounting for persons responsible for emissions, a combination of chemistry, engineering, and cost accounting was utilized in this study to break down carbon emissions into specific outputs. (Roberts and Karthak, 2021) A system of accounting for those

responsible for carbon emissions may allow the government to impose taxes on entities that produce a disproportionate amount of those emissions while lowering taxes on those that produce a lesser amount. This conclusion was reached by applying the study to an enterprise manufacturing car doors. This study aimed to review the accounting literature on the effects of climate change in financial reports. Carmela et al. (2020) applied mathematical and statistical techniques to books and scientific theses; this study used a scientific map analysis tool. They concluded that there is a clear and strong relationship between climate change and sustainable development. It is also possible to achieve a healthy climate using renewable energy.

Praveen and Mohammed (2020) examine the processes for disclosure of financial statements and reporting. Businesses employ accounting procedures when establishing, measuring, presenting, and declaring carbon balances in their financial statements. According to the report, 91.60% of businesses do not disclose how they determine the stock of emissions shares, and 40.46% classify the provision for reducing carbon emissions as other revenue. Additionally, the sample excludes the cost of acquiring carbon credits in 92.36% of the cases. Ahmed (2020) aimed to determine the impact of accounting measurement of revenues, expenditures, and obligations of greenhouse gas emissions on corporate profitability. This analysis concluded that there is no way to disregard the enormous influence of carbon emission expenses and income on financial statements. The cost of carbon emissions burdens the business; therefore, weighing the benefits and costs is vital before spending money. One of the most crucial methods for reducing emissions is the price of carbon emission rights. The second is the use of carbon credits. Ibrahim (2020) sought to provide an analytical presentation of the rules and measurement of assets and liabilities, considering the conceptual framework of (IASB). In addition, it assesses the suitability of these rules for application to rights and claims arising from trading operations related to greenhouse gas emissions. The researcher proposed a model for the accounting treatment of these emissions. Elmalah (2018) also sought to examine the relationship between voluntarily disclosing carbon emissions and a company’s financial performance by applying it to nine companies listed on the Egyptian Stock Exchange and covering five industries: chemicals, financial services, the sector and construction materials, gas, oil, and primary resources. They discovered that a company’s financial performance is positively correlated with its level of voluntary disclosure of greenhouse gas emissions.

Table 1: The relationship between the principles of sustainable development and the role that carbon emissions accounting plays in achieving those principles

Principles of sustainable development	The r7y mole of carbon emissions accounting in achieving the principles of sustainable development
<ol style="list-style-type: none"> 1. Reducing the increase in global temperatures 2. Waste management and treatment 3. Optimal exploitation of resources 4. Extending the economic life of resources 5. Creating an environmental balance and preserving biodiversity 6. Developing production and increasing investment 7. Reducing emissions into the atmosphere 8. Conserving water (Public Health, 2019)	<ol style="list-style-type: none"> 1. Monitoring carbon emissions 2. Measuring their cost and tracking them to reduce and eliminate them 3. Finding alternative methods and products that are less expensive and more environmentally friendly 4. Recycling products to achieve profits and increase revenues 5. Excluding companies that have high emissions costs and imposing fines on them until they improve their environmental performance (Osama, 2023 and Lauren, 2022)

Harman et al. (2022) examined the relationship between sustainable development goals and the GDP growth rate to measure the country's economic health. More investment should be made in education and training to help create sustainable job possibilities for human capital. Bahram and Lauren (2022) examined the relationship between sustainable development objectives and gross domestic product. This study found conflicting results between the growth of the domestic product and the accomplishment of sustainable development objectives, as slow growth results in a reduction in emissions and a reduction in death rates, but it does not achieve sustainability. (Lena, 2022) The main goal was to construct a paradigm demonstrating how one another mediated social and economic systems, environmental systems, and climate change-related costs. Maps of the content analysis were employed. This study concluded that all ecosystems directly impacted 24% of the 169 SDGs, making them the least achievable of the 17 SDGs outlined in the UN Convention.

Naceri and Semred (2021) also attempted to illuminate the realities of green accounting and its contribution to sustainable development. The study concluded that the environmental aspect is a crucial predictor of sustainability and development.

4. RESEARCH METHOD AND DATA COLLECTION

A primary source is consulted to analyze the position regarding the three pillars of Sustainability of Accounting Evaluation of Carbon Emissions and Climate Change. A field study for Aramco company was conducted. It is one of the world's largest integrated energy and chemical corporations. Aramco adds value along the hydrocarbon chain and helps people and communities that depend on the essential energy it provides on a social and economic level. It is determined to take the lead in the energy transition. A survey was distributed to the managers of the Aramco company. A questionnaire was designed to assess their opinions on practices related to these topics. The questionnaire included questions about the sustainability pillars (economic, social, and environmental). A 5-point Likert scale was used, wherein one indicated "strongly disagree" and five indicated "strongly agree."

The study sample was based on 150 randomly selected mid-level managers in Saudi Arabia. Middle-level managers were selected because they were college graduates proficient in English, and they shared opinions without much hesitation. A total of 120 completed questionnaires were collected from the participating managers. The ages of the surveyed managers varied from 30 to 50 years.

The data were analyzed by tabulating a set of statistical analysis methods appropriate to the study's nature and fitting the hypotheses. SPSS software was used for analysis. The survey contained 33 phrases or variables divided into four groups. An arithmetic mean and standard deviation are descriptive statistical approaches that assist in presenting the data in a more understandable and comprehensible manner. The Dispersion measures quantify how widely data vary from their arithmetic mean.

Furthermore, the reliability and validity coefficients were calculated. Correlation coefficient and coefficient of determination. Finally, the ANOVA multiple variance analysis approach, which is more suited to the characteristics of the data and the study factors, was used to quantify the degree of variation or difference in the research variables.

5. RESULTS

5.1. Reliability and Validity Coefficients for the Questionnaire List

A. Stability of the scale

The reliability coefficient for each dimension of the study was higher than (0.60), and the stability coefficients for the questionnaire list amounted to (0.956). Thus, the questionnaire list was characterized by a high degree of stability (Table 2).

B. Scale validity

It turns out that the degree of the validity coefficient for each dimension of the study is higher than (0.60) and that the validity coefficients for the questionnaire list amounted to (0.978). Thus, the questionnaire list is characterized by high honesty, which means it is proper to what it was set for.

5.2. Hypothesis Tests

Main-Hypothesis,

"There is a statistically significant effect of accounting for carbon emissions in achieving sustainable development through its three dimensions (economic-social-environmental)."

Sub-Hypothesis:

H1: There is a statistically significant effect of accounting for carbon emissions in achieving sustainable development through the economic dimension."

H2: "There is a statistically significant effect of accounting for carbon emissions in achieving sustainable development through the social dimension."

H3: "There is a statistically significant effect of accounting for carbon emissions in achieving sustainable development through the environmental dimension."

A. Correlation coefficient

The following Table 3 shows the correlation coefficient of all hypotheses between carbon emissions as an independent variable and sustainable development, economic dimension, social dimension, and environmental dimension as dependent variables.

The previous table clearly shows a statistically significant correlation of 85.7%, 86.6%, and 87.4%, respectively, at a

Table 2: Reliability and validity of the questionnaire list

Dimension	Stability	Validity
Accounting for carbon emissions	0.947	0.973
Economic dimension	0.924	0.961
Social dimension	0.795	0.892
Environmental dimension	0.916	0.957
All items of the questionnaire as a whole	0.956	0.978

significance level of 0.05, between carbon emissions as an independent variable and sustainable development, the economic dimension, and the environmental dimension. On the other hand, there is a very weak correlation of 10.1%, which is not statistically significant as the significance level is greater than 0.05, between accounting for carbon emissions and the social dimension.

B. The coefficient of determination:

The Table 4 shows that the coefficient of determination = 0.734, 0.750, and 0.764. This indicates that accounting for carbon emissions explains the change in sustainable development, economic, and environmental dimensions by 73.4%, 75.0%, and 76.4%, respectively. The remaining percentage is explained by other variables not included in the regression relationship. However, the social dimensions cannot be explained by

accounting for carbon emissions, as indicated by the coefficient of determination $R^2 = 0.009$.

C. ANOVA test

The Table 5 shows a direct and significant correlation between accounting for carbon emissions and sustainable development's environmental and economic pillars. This is demonstrated by the value of "F," which is statistically significant. Illustrating the validity and significance of the variables, the excellence of the framework, and the reliability of relying on its conclusions in the absence of errors. On the other hand, there is no significant correlation between accounting for carbon emissions and the social dimension, the value of "F" is not statistically significant, and the significance level is higher than 0.05, which indicates the invalidity and essentiality of the relationship between the two variables.

Table 3: Correlation coefficient for all hypotheses

Independent variable	Test	Dependent variables			
		Sustainable development	Economic dimension	Social dimension	Environmental dimension
Accounting for carbon emissions	Pearson Correlation	0.857	0.866	0.094	0.874
	Sig.	0.000	0.000	0.154	0.000

Table 4: Coefficient of determination

Independent variable	Test	Dependent variables			
		Sustainable development	Economic dimension	Social dimension	Environmental dimension
Accounting for carbon emissions	R^2	0.734	0.750	0.009	0.764
	Juttet R^2	0.732	0.748	0.000	0.762
	Error of estimation	0.7396	0.3666	0.37031	0.3102

Table 5: Analysis of variance

Hypotheses	Model	Sum of Squares	d.f.	Mean Square	F	Sig.
Main hypotheses	Regression	178.02	1	178.02	325.43	0.000
	Residual	64.548	118	0.547		
	Total	242.57	119			
Sub hypotheses 1	Regression	47.501	1	47.501	353.54	0.000
	Residual	15.854	118	0.134		
	Total	63.355	119			
Sub hypotheses 2	Regression	0.144	1	0.144	1.049	0.308
	Residual	16.181	118	0.137		
	Total	16.325	119			
Sub hypotheses 3	Regression	36.857	1	36.857	383	0.000
	Residual	11.355	118	0.096		
	Total	48.212	119			

Table 6: Analysis of the regression

hypotheses	Model	Unstandardized Coefficients		Standardized Coefficients	t.	Sig.
		Std. Error	B	Beta		
Main hypotheses	Constant	5.647	0.318	0.857	17.778	0.000
	Variable	1.587	0.088		18.04	0.000
Sub hypotheses 1	Constant	0.656	0.157	0.866	4.17	0.000
	Variable	0.82	0.044		18.803	0.000
Sub hypotheses 2	Constant	3.96	0.159	0.094	24.903	0.000
	Variable	0.045	0.044		1.024	0.308
Sub hypotheses 3	Constant	1.03	0.133	0.874	7.733	0.000
	Variable	0.722	0.037		19.57	0.000

D. Regression analysis

According to the Table 6, the main, sub1, and sub3 hypotheses have significant t-test values for the variable accounting for carbon emissions at a significance threshold of 0.05. This demonstrates the strength of the regressive relationship between carbon emissions and sustainable economic and environmental development. The author accepts the hypotheses for the main, sub-1, and sub-3 hypotheses. On the other hand, for the sub-2 hypotheses, the values of the “t” test for the variable accounting for carbon emissions were not significant, and the level of significance was >0.05, indicating the weakness of the regressive relationship between carbon emissions and the social dimension. Therefore, we reject the sub-2 hypotheses.

5. CONCLUSION

The author of this paper tries to explain the factors that must be considered when using international accounting standards to keep up with climate change and determine how carbon emissions affect financial statements. She also aimed to elucidate the theoretical foundations of carbon emissions accounting measurements owing to climate change and its impact on sustainability. The author uses an inductive technique to conduct the research based on reading and assessing accounting-related scientific research and sources, such as books, references, journals, reports, conferences, and questionnaires. The results of the theoretical parts are as follows:

- -The significance of accounting measurement of carbon emissions shares’ assets and liabilities to serve both internal and external parties of businesses whose activity is related to thermal emissions
- Because what can be quantified can be controlled effectively, accurate and unified accounting measurements of the assets and liabilities of the shares of thermal carbon emissions can aid in reducing those emissions.
- Thermal carbon emissions have a substantial impact on income and financial statements.

Since the efforts of scientific and professional organizations take the form of non-obligatory proposals and recommendations for businesses whose activities are related to thermal emissions, there is no formal and legally enforceable standard for the principles of accounting for thermal carbon emissions.

Numerous studies and academic research have attempted to illuminate the use of fresh and cutting-edge bases for calculating the cost of carbon emissions and attempting to cut them, such as the sustainable, balanced performance measure, which added a fifth dimension to the scale, namely the environmental dimension.

Carbon accounts for 75% of all greenhouse gases, so it is included in the accounting for greenhouse gas emissions.

The results of the applied study show that accounting for carbon emissions has a statistically significant effect on achieving sustainable development through its three pillars (economic, social, and environmental). Further, accounting for carbon emissions has a statistically significant effect on achieving sustainable development through the economic and environmental

dimensions. There is no statistically significant effect of accounting for carbon emissions on achieving sustainable development through the social dimension.

6. RECOMMENDATION

- Scientific and professional organizations that are experts in defining standards must band together to establish a unique standard for calculating carbon emissions and apply it legally.
- Support for clean production activities on a global scale.
- -Since trees serve as the planet’s lungs by absorbing carbon dioxide, which accounts for most of those emissions, deforestation must be permitted to reduce thermal carbon emissions.
- Reduce nitrogen-containing organic fertilizers and switch to green manure made from seaweed.
- Ammonia and hydrocarbon gases should be used instead of fluorine for refrigeration and air pumping because fluorine gases have more negative impacts than carbon dioxide.
- It is necessary to focus on the social component of sustainable development, educate big businesses about its significance in achieving environmental sustainability, and hold businesses accountable when they fail to uphold human rights and disregard society and the environment for their surroundings.

For future research, the author suggests the following topics.

- Impact of fluctuating exchange rates on the identification and calculation of greenhouse gas emission shares.
- Sustainable, balanced performance measures climate damage costs and lowers them.

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