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Role of Financial Reporting on Carbon Emissions in Enhancing the Relevance of Accounting Information

Sana Tuama Kudair *
Dept. of Accounting,
College of Administration and Economics
University of Baghdad
Baghdad, Iraq
sanatuama@gmail.com
***Corresponding author**

Lubna Zaid Ibrahim
Dept. of Accounting,
College of Administration and Economics
University of Baghdad
Baghdad, Iraq
drlobna@coadec.uobaghdad.edu.iq

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Abstract:

In an effort to enhance the applicability of accounting data for international oil corporations operating in Iraq, this study delves into the role of Financial Reporting on Carbon Emissions (FRCE). The researchers explore the overarching concept and significance of the Relevance of Accounting Information (RAI) in general, with a specific focus on its application to accounting information related to carbon emissions. The study also addresses the financial reporting of carbon emissions in industrial companies. Using two mathematical models, namely the Informational Content Model (ICM) and Autoregressive Integrated Moving Average (ARIMA), the researchers conduct an in-depth analysis of eleven years' worth of financial statements from Dana Gas, forming the basis of this study's sample. The analysis is performed using SPSS. Several conclusions have emerged from the study, with a pivotal finding being that ensuring the relevance of accounting information related to carbon emissions aligns with both user requirements for accounting information and the imperatives of environmental preservation. Moreover, the study underscores the impact of financial reporting on carbon emissions programs and greenhouse gas emissions on the relevance of accounting information, thereby influencing the overall quality of financial reporting. The study highlights that enhancing the suitability of information through financial reporting on carbon emissions contributes significantly to elevating the standard of financial reporting for the firm. As a recommendation, the researchers advocate for compliance with local laws or international treaties regulating carbon emissions, emphasizing the inclusion of accounting information and financial reports detailing expenses associated with carbon emissions in these compliance efforts.

Paper type : Research paper

Keywords: Carbon Emissions, Financial Reporting, Relevance of Accounting Information, Materiality, Confirmatory value, Predictive value.

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1.Introduction:

Growing carbon emissions are one of the modern problems affecting life on Earth. Climate change is a result of human activities that intensify the greenhouse effect and produce carbon emissions. Fossil fuel burning produces the majority of carbon emissions (coal, oil, and natural gas). The main producers of these pollutants are industrialized nations like China, Russia, Europe, and the United States. Since the Industrial Revolution, there has been a noticeable rise in the atmospheric concentration of carbon dioxide due to carbon emissions. Along with the production of electricity and the transportation sector, industries involved in the extraction and refinement of oil and natural gas are thought to be among the main causes of the rise in carbon emissions. This covers the engines found in automobiles, aircraft, and ships. In addition, the elimination of green spaces, which are thought of as the Earth's natural filters and lungs, and extensive deforestation are major causes of atmospheric carbon pollution.

However, by advancing technology, funding research and development, and establishing atmospheric pollution control guidelines, carbon emissions may be decreased. Innovations boost capital and labor productivity, which is essential for economic expansion. The idea that spending money on R&D has an effect on technical advancements is backed by the endogenous growth hypothesis. Thus, the researchers think that in order to achieve both economic growth and a reduction in carbon emissions, technical advancements and expenditures in research and development are common elements.

Research and development spending's contribution to the reduction of carbon emissions is correlated with how economic firms' financial reporting affects accounting data that is pertinent to the environment. To satisfy the requirements of outside regulatory agencies and the general public, economic entities work to expand the disclosure of accounting information pertaining to the environment. In actuality, there are no trustworthy accounting norms, hence the disclosure of this kind of information differs. Research in the pertinent literature suggests that disclosure of accounting information connected to the environment is crucial for controlling corporate risks, gaining competitive advantages, and empowering stakeholders to make informed decisions. Economic enterprises are thus under more general and regulatory demand to report the effects of their industrial and commercial operations on society and the environment. The researchers consider accounting as a behavioral knowledge that is pertinent to Ecological and socioeconomic issues because of the importance of funding R&D and the requirement to report financial and non-financial data connected to surrounding environment. FRCE is a specialist discipline that has emerged from it. Relevant accounting firms have begun creating FRCE - specific principles and concepts in order to improve firms' disclosure of information about their carbon emissions, develop strategies to reduce emissions, and encourage green goods and carbon accounting management - all of which contribute to achieving environmental sustainability.

1.1 Literature Review:

Many studies have examined FRCE:

Khatab et al. (2016) advocated for the establishment of official standards in voluntary environmental disclosure, emphasizing the need for a structured framework to facilitate the sharing of ecological data. Their recommendation extends to encompass the inclusion of emission costs and a nuanced exploration of how such disclosures impact business performance. This proposed structure, according to the study, serves to mitigate uncertainty and elevate the quality of financial information. Addressing the challenges faced by industrial firms, the study aimed to devise a comprehensive framework for the enhanced disclosure of environmental information, specifically concerning the costs associated with hazardous emissions and their implications on financial outcomes. Employing a range of statistical methods, including multiple regression analysis, Pearson correlation analysis, and descriptive statistics, the research systematically evaluated its hypotheses.

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A key finding of the study underscores the importance of professional associations and regulatory bodies adopting standardized accounting measures. Such measures, the study suggests, would not only regulate the disclosure of greenhouse gas emissions but also enhance the precision of accounting data. This recommendation signifies a crucial step toward fostering transparency, reliability, and uniformity in environmental disclosure practices within the business landscape.

In a pursuit to enhance firms' efficiency and elevate the quality of both financial and non-financial data, Sharaf El-Deen (2018) delved into the intricacies of carbon pricing procedures and their role in diminishing emissions values. The study aimed to advocate environmentally friendly manufacturing practices, minimize carbon emissions, and ultimately augment a firm's overall value. Sharaf El-Deen explored the significance of carbon pricing in emission reduction and resource optimization, addressing the challenge of determining the focus of research efforts—whether on carbon pricing mechanisms, emissions trading systems, carbon taxes, or a combination thereof. The objective was to pinpoint the most effective mechanism for pricing carbon, assessing its efficacy in managing emissions values and supporting environmentally sustainable practices. The study also scrutinized the accounting implications of these mechanisms, emphasizing measurement and disclosure perspectives. Employing a case study methodology involving top global firms engaged in carbon pricing, the research employed a theoretical lens to analyze pertinent literature and international practices in the realm of carbon pricing techniques. The study yielded key insights: it emphasized the critical role of accounting transparency in emissions reduction, highlighted the efficacy of carbon pricing schemes in enhancing carbon consumption and fostering clean manufacturing. Furthermore, it recommended the development of mandated accounting disclosures outlining the costs of harmful emissions and endorsed the adoption of carbon pricing systems. These conclusions underscore the pivotal role of accounting practices in steering businesses toward environmentally responsible and sustainable paths.".

By elucidating the potential to bolster support for the reporting of carbon accounting, Fadhal et al. (2021) aimed to enhance the transparency of financial reporting in manufacturing firms. The study sought to discern the impact of implementing carbon accounting and voluntary disclosure on the quality of financial reporting, assessed through the transparency scale model and descriptive data analysis. Several noteworthy conclusions emerged from the study, with a paramount finding indicating that companies do not consistently adopt carbon-related systems, including allowance trading systems. Moreover, the research highlighted that the mere inclusion of carbon-related information in reports does not necessarily lead to an improvement in the quality of financial reporting. A key implication of the study is the recommendation for further research in the realm of climate change, considering the escalating levels of atmospheric carbon emissions. The study underscores the need to delve into the intricate relationship between carbon allowance measurement, disclosure practices, and financial report transparency. This emphasis on understanding these connections is vital for enhancing the suitability of financial reports for investors and other stakeholders in navigating the complexities of environmental considerations and their impact on financial reporting transparency.

According to Al-Sarraf and Al-Taie (2022), Financial Reporting on Carbon Emissions (FRCE) within Iraqi economic organizations is significantly influenced by governance systems and accounting transparency. The study investigates the impact of ownership concentration, board composition, and overall company governance on the facilitation or hindrance of FRCE. The research reveals a positive correlation between the extent and quality of FRCE and effective governance systems, particularly those marked by strong board independence and shareholder concentration. This correlation underscores the connection between corporate governance and the transparency of reporting on sustainable development.

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The findings advocate for legislative measures aimed at enhancing governance to effectively reduce carbon emissions in Iraqi enterprises. Furthermore, the study underscores the pivotal role of governance in promoting sustainable economic practices. It posits that improved governance can foster increased accountability and transparency in sustainability reporting, benefiting both businesses and society at large.

Jasim and Al-Mashhdani (2022) delved into the influence of various credit loss forecasting techniques on Financial Reporting on Carbon Emissions (FRCE). The research scrutinized the effects of diverse credit risk assessment methods, including default probability models, on the identification and quantification of carbon-related obligations. Notably, the results underscored that the choice of credit loss forecasting technique significantly impacts how carbon emissions are financially reported, potentially leading to variations in recognized liabilities. This highlights the intrinsic connection between credit risk management and environmental reporting. The study advocates for the standardization of approaches to FRCE, emphasizing the importance of ensuring accuracy and consistency in portraying a firm's environmental impacts. Furthermore, the research underscores the necessity of aligning financial and sustainability reporting to guarantee a comprehensive and integrated representation of a company's overall performance.

Thabit et al. (2022) comprehensively addressed the concept of carbon accounting and its guiding principles, shedding light on global constraints for environmental reporting and the disclosure of carbon allocations. The study delved into the response of accounting science to the threats posed by climate change, exploring the methodologies developed and the integral role played by accounting firms in this response. Notably, the research assessed the impact of climate change threats on the global progress of carbon accounting. To facilitate decision-makers' understanding of the potential effects of climate change on firms' performance, the study applied a set of standard accounting procedures representing the associated risks. The study focused on firms within the industrialized world's economies as its sample, specifically those characterized by excessive harmful emissions in their operational activities. The key conclusion drawn from the research highlighted the profound influence of climate change on the evolution and functioning of carbon accounting in risk management. It emphasized that the competitive advantage derived from effective carbon accounting significantly affects the accuracy of accounting data. In light of these findings, the research proposed careful consideration of carbon accounting to enhance the economic value of industrial units and advance the science of accounting by incorporating environmental and social components. Furthermore, it recommended that decision-makers within firms explore alternative energy sources or products with zero emissions to align with policies aimed at mitigating climate change. This comprehensive study underscores the critical interplay between climate change, carbon accounting, and the imperative for businesses to embrace sustainable practices for economic and environmental resilience.

The relevance of accounting information (RAI) has been covered in a number of studies, including:

The relevance method, integral to evaluating the quality of information pertinent to financial market investment decisions, stands as a crucial avenue in accounting research within the realm of capital markets. Al-Jarf (2017) expounded on the impact of accounting transparency on the Relevance of Accounting Information (RAI) in the context of joint-stock firms adhering to reporting requirements. The study addressed the ramifications of applying specific accounting standards to these decisions, along with the establishment of foundations and guidelines for accounting measurement and disclosure. These guidelines, as elucidated by the study, play a pivotal role in defining the relationship between management and other stakeholders within the firm, aiming to align their goals and mitigate short-term conflicts.

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To empirically assess the impact, the study examined variations in the value of stock market averages for the sample data before and after the application of financial reporting rules. The observed variations suggested a discernible effect resulting from the application of these criteria. Employing the coefficient of determination (R2) to gauge RAI, the study measured the degree of change in this value for the sample data pre and post the implementation of reporting standards. Notably, the study focused on metrics such as book value per share (BVPS), operating profit per share (OPPS), earnings per share (EPS), and market value per share (MVPS). The findings underscored that the application of financial reporting standards indeed influences RAI. This underscores the significance of implementing such standards in joint-stock companies, not only for regulatory compliance but as a strategic means to attract capital and foreign investments. The study posits that these investments, in turn, positively impact individual well-being and national income, emphasizing the broader economic implications of robust financial reporting practices.

Badwy (2019) investigation into the valuation of joint-stock firms delved into the Relevance of Accounting Information (RAI), gauged through operational cash flows, book value of equity, and accounting profits. The study operated on the premise that joint-stock corporations exhibit significant variations in the utility of financial and non-financial data for valuation purposes. To assess these assumptions, three regression models were constructed. The study's key conclusion underscores the importance of accounting data in estimating the overall worth of joint-stock businesses. Notably, it found that investors primarily rely on the book value of equity to assess share prices in these companies. Additionally, albeit to a lesser extent, investors in joint-stock businesses also show interest in earnings per share. This underscores the crucial role of accounting data in shaping management decisions, providing insights into the information investors and standard setters deem essential. The observation that investors place significant emphasis on accounting metrics aligns with the broader trend in the financial landscape. It emphasizes the symbiotic relationship between financial reporting practices and investment decision-making. Moreover, the study highlights the dual objective of standard setters: to elevate standards for disclosure and transparency while ensuring that investors receive the requisite information to make informed decisions. This emphasizes the pivotal role that accounting information plays in bridging the communication gap between corporations and their stakeholders in the capital market.

Mohammed and Abdullah (2022) explored the nexus between audit quality and the Relevance of Accounting Information (RAI) within the framework of an expert system. Their study assessed the contributions of independence, experience, and audit criteria to ensure the reliability and accuracy of data. Notably, the research found that higher audit quality, particularly in the context of expert systems, positively impacts the transparency and credibility of RAI. The findings underscore the pivotal role of robust audit procedures in confirming and validating environmental data, emphasizing the significance of ensuring accurate and trustworthy information. The study proposes that companies utilizing expert systems for accounting information, particularly in the context of emissions disclosures, should prioritize audit quality to enhance the credibility of their disclosures. In essence, the results highlight the synergistic relationship between expert systems and stringent auditing procedures as a strategy to bolster the Relevance of Accounting Information.

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Haider et al. (2022) delved into the dynamic nature of the Relevance of Accounting Information (RAI) over time, particularly in the context of banks and businesses. The research sought to gauge how effectively factual information derived from these entities could estimate price changes and elucidate pricing fluctuations over an extended period. To assess the evolving relevance, the research methodology involved estimating a cross-sectional model for the variables in each year. The researchers extracted coefficients indicative of appropriateness and employed a series of trend curves to quantify the developmental trajectory of the value across the study period. The study's noteworthy conclusion emphasizes the practical application of its techniques for investors. By discerning the appropriate times to rely on accounting features for predicting changes in price, investors can strategically leverage the insights gleaned from the research. This underlines the importance of recognizing the temporal dynamics of RAI, providing investors with valuable tools to navigate fluctuations in financial markets and make informed decisions based on the evolving relevance of accounting information over time.

Yousif and Mohamed (2022) conducted a study on the Relevance of Accounting Information (RAI) within the sphere of strategic operations, specifically examining how the quality and RAI for strategic decision-making are influenced by internal audit operations. The study scrutinized key facets of internal audit, including risk assessment, controls review, and fraud detection. The research underscored that a robust internal audit function plays a pivotal role in ensuring the accuracy of data and aligning it with strategic objectives, thereby enhancing RAI. This highlights the critical function of internal audit in safeguarding the precision of financial data and facilitating well-informed strategic decisions. To optimize the value of accounting information in achieving strategic goals, the study emphasizes the imperative for firms to tightly integrate internal audit procedures into their strategic planning and execution processes. This integration serves as a strategic imperative to ensure the reliability and relevance of accounting information in the context of strategic decision-making.

Dafroor and Soly (2023) illuminated the impact of accounting rules on the Relevance of Accounting Information (RAI) by highlighting the most significant accounting measures employed by the institution in financial statements. Utilizing data gathered from books, journals, and relevant sources, the study employed a descriptive approach in the theoretical segment to establish the conceptual framework for each accounting policy and its relevance in financial reporting statements. The researchers engaged in a comprehensive discussion of prior research, delineating the distinctions and parallels between earlier studies and their current research. To fortify the theoretical foundation, an applied inductive method with a field investigation involving a sample of professionals was employed. A total of 50 questionnaires were distributed, resulting in the collection of 48 valid responses. The study employed SPSS software to analyze the surveys, ultimately concluding that accounting procedures exert both positive and negative effects on the relevance of financial statements. This nuanced understanding underscores the complex interplay between accounting rules and the efficacy of financial reporting, emphasizing the need for a nuanced approach to accounting practices to optimize the relevance of financial information.

On another note, numerous studies have addressed the definition of RAI. IASB (2018) defined it as the ability of information to induce a change in the direction of decisions. RAI at a specific time is gauged by the extent to which it helps its users form expectations about the expected outcomes of past, present, or future events. If expectations already exist, relevant information has the ability to reinforce or correct those expectations. In both cases, appropriate information is that which leads to an increase in the degree of confidence for decision-making. Kieso et al. (2022) confirmed that accounting information is relevant when it allows users to accurately assess past, present, and future events.

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It is only useful if its neglect results in a negative impact on decisions made by users. Benston et al. (2007) suggested that RAI can be described if it possesses predictive value, confirmatory value, and relative importance. Spiceland et al. (2022) emphasized that accounting information has predictive value if it can be used as an input for processes that users employ to predict future outcomes. The use of financial information with predictive value by users is not limited to having the characteristic of prediction or expectation, but rather financial information with predictive value is used by users to set their own expectations. Nayeri et al. (2012) affirmed that accounting information has confirmatory value when it provides insights into confirming or changing previous evaluations. The predictive value and confirmatory value of accounting information are interconnected, as information that has predictive value often also has confirmatory value. Relative importance, as elucidated by Jones and Smith (2011), lies in the capacity of accounting information to have substantial effects on decisions made by primary users for general-purpose financial reporting, providing specific information about the economic entity reported. Thus, relative importance is an aspect related to the economic entity based on the nature or size of the items reported or both. Therefore, the International Accounting Standards Board cannot set a uniform threshold for relative importance or predefine what may be essential in a specific situation. Ortas et al. (2015) demonstrated that RAI is used to assess the quality of financial reporting for the economic entity, as this characteristic is crucial in the qualitative characteristics of accounting information. Zhang et al. (2016) confirmed an inverse relationship between the growth of the economic entity and the degree of relevant of its accounting information. Investors place significant emphasis on the predictive and confirmatory value of accounting information to make investment decisions. Schaltegger and Csutora (2012) explained that RAI also influences the development of modern economic entities seeking market listing. Investors target modern economic entities with suitable accounting information, regardless of the profitability of their shares or the value of the debts owed. Investors especially focus on RAI when reviewing cash flows for the economic entity and estimating potential risks it might face.

A few studies connected and examined the relation between FRCE and RAI:

By comparing ownership equity with actual and expected net income, analyzing retained earnings, and comparing the quality of actual and expected earnings, Ebaid (2016) argued about the impact of PV as a sub-characteristic of relevance on decisions made within the firm. She also highlighted the detrimental effects of making inaccurate earnings predictions or evaluating assumed benefits on the ongoing operations of the firm. The study's findings showed that, according to earnings management, accounting quality has decreased from the pre-adoption era. The purpose of International Financial Reporting Standards (IFRSs) is to provide better financial reporting. However, following legal standards alone won't suffice to do this. The accounting system is an integral part of the country's overall institutional framework. The adoption of IFRS was not accompanied by any institutional upgrades by the government. The government did not implement sufficient institutional IFRS understanding, needed corporate governance regulations, tougher enforcement mechanisms, or investor protection measures at that period. Therefore, even if IFRS are higher quality standards and can improve RAI on carbon emissions, any improvement in accounting quality brought about by the implementation of IFRS may be offset by the institutional features of the market.

According to Campbell et al. (2020), streamlining data collection and analysis processes is one of the primary strategies that might lead to the capture of accurate and relevant data. The application of appropriate analysis tools, such as data mining and artificial intelligence, can improve the quality of accounting information and identify its CV as a sub-characteristic of importance. Enhancing the disclosure procedures can also significantly reduce the cost of accounting data and facilitate its quantification. This is achieved by doing away with the need for investors to thoroughly assess the financial reports of the economic firm.

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But still The efficiency of internal control systems inside the business has an indirect impact on how well CV of accounting information is evaluated. Robust internal controls lower the risk of fraud and errors, which enhances the quality of accounting data. Initiatives promoting transparency and accountability may also improve the quality of accounting data, enhancing its CV. These measures include a detailed accounting of the economic entity's environmental policy, training employees on the importance of FRCE, and promoting accurate and transparent carbon emission reporting. Continuous, routine monitoring and auditing of accounting data related to carbon emissions to identify and promptly correct errors and anomalies may also have a significant influence on CV evaluation.

The researchers' assertion that enhancing Financial Reporting on Carbon Emissions (FRCE) will contribute to improving the Relevance of Accounting Information (RAI) and, consequently, enhance the overall quality of financial reporting in industrial enterprises sets the foundation for the research problem. Consequently, the research problem can be formulated as follows: What role does FRCE play in enhancing RAI within Iraq's oil and gas industry?

The primary objective of the study is to explore the interconnections between financial reporting, Predictive Value (PV), Confirmatory Value (CV), and Materiality (MT) of accounting information. The overarching goal is to quantitatively assess the impact of FRCE on the relevant characteristics of accounting information, aiming to provide insights into the relationship between carbon emissions reporting and the informational quality within the context of Iraq's oil and gas industry.

2.Material and Methods:

2.1 Research Sample and Population:

International businesses engaged in the oil and gas industry in Iraq's Kurdistan region make up the research population. However, it consists of 11 firms, and DANA Gas Company was chosen to represent its joint venture investments at a percentage of 0.19 of entire investments. Because it is the largest and the oldest foreign commercial firms working in Kurdistan, the study sample unit was chosen. It also exhibits a dedication to social responsibility, complies with environmental and sustainability rules and laws, and offers comprehensive financial and environmental statistics.

2.2 Hypotheses test:

The primary hypothesis of the study is that "FRCE impacts the quality of RAI." It leads to the following sub-hypotheses:

- H1: Financial Reporting on Carbon Emissions (FRCE) enhances the Predictive Value (PV) of accounting information.
- H2: Financial Reporting on Carbon Emissions (FRCE) enhances the Confirmatory Value of accounting information.
- H3: Financial Reporting on Carbon Emissions (FRCE) enhances the Materiality (MT) of accounting information.

2.3 Data Analysis and Results:

According to the released financial statements on the firm's official website, the researchers examined balance sheet statements and income statements of the research sample firm (DANA Gas) for a period of 11 years, between 2011 and 2021, to meet the research main goals of determining the part of FRCE in enhancing RAI reported in the financial statements. Measuring the MT, PV, and CV of accounting information using pertinent statistical methods and the mathematical models (ICM and ARIMA) described in the theoretical framework. The researchers then made adjustments to these financial statements to reflect the sustainability reports that the business had released and made available on its website.

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2.3.1Analysing the financial statements:

The research sample firm's balance sheet statements and income statements, which are accessible on its official website (www.danagas.com), gave the researchers financial details about the firm. Data related to fixed assets and intangible assets in the balance sheet, operational and depletion costs, other expenses, and income tax expense in the income statement all contained disclosures regarding carbon emissions, according to reports on governance, social responsibility, sustainability, and regulatory disclosures as well as the firm's health, safety, security, and environmental procedures. As a result, the researchers examined this data and created the research sample firm's amended income statement and balance sheet, as shown in Tables 1 and 2.

Table 1: The research sample firm's adjusted balance sheets with regard to carbon emissions reporting for the years 2011 through 2021 (numbers are in the tens of millions)

Item	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
FA	78.40	77.80	74.50	76.10	83.40	85.60	108.00	100.10	99.50	78.70	78.30
TFA	24.80	20.70	21.50	18.60	19.80	24.90	38.20	22.50	20.80	16.10	23.00
CEFA	119.40	106.90	112.60	107.30	113.30	107.20	98.10	101.40	106.20	75.00	43.70
ITFA	8.10	6.10	6.20	10.40	5.60	8.30	8.90	11.40	5.20	11.20	5.30
CO	5.97	22.32	12.60	11.80	11.80	9.50	13.40	8.50	8.50	15.70	6.40
CA	78.40	77.80	74.50	76.20	83.40	85.60	108.00	100.10	99.50	78.70	78.30

Where: FA = Fixed Assets, TFA = Traditional Fixed Assets, CEFA = Related Carbon Emissions Fixed Assets, ITFA = Intangible Tradition Fixed Assets, CO = Carbon Offsets, and CA = Carbon Allowances

Table 2: The research sample firm's adjusted income statements for the reporting of carbon emissions for the years 2011 through 2021(numbers are in the tens of millions).

Item	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TODC	9.460	8.100	8.800	9.320	7.570	8.060	9.770	8.470	8.690	8.820	7.440
CEOC	1.540	0.800	1.800	2.480	1.340	1.940	1.330	1.730	2.310	1.280	2.160
TOE	0.000	0.000	0.000	0.264	0.568	1.416	1.398	1.606	0.648	0.986	1.264
OECE	0.000	0.000	0.000	0.136	0.232	0.485	0.602	0.594	0.152	0.114	0.336
TIT	7.700	6.500	5.050	5.370	1.200	2.970	2.820	2.243	1.274	0.336	2.360
ITCE	0.700	-0.200	0.250	-0.270	0.100	0.130	0.980	0.857	0.126	0.064	-0.160

Where: TODC = Operational and Depletion Costs, CEOC = Carbon Emissions Operational Costs, TOE = Traditional Other Expenses, OECE = Other Expenses related to Carbon Emissions, TIT = Traditional Income Tax, and ITCE = Income Tax related to Carbon Emissions.

2.3.1.1 PV of Accounting Information:

Using the autoregressive integrated moving average model (ARIMA), the best model for the current study, the researchers examined PV of the financial data on carbon emissions found in the research sample firm's traditional and adjusted balance sheets within the research's time constraints. Equation 1 provides a mathematical expression for this model.

$$A_t = b + \varphi_1 A_{t-1} + b + \varphi_2 A_{t-2} + \cdots + \varphi_p A_{t-p} + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \cdots + \theta_q \varepsilon_{t-q} \quad (1)$$

Where:
A_t = Actual PV
ε_t = Random error in time
φ_I, θ_I = Statistical coefficients

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The data that the researchers used came from quarterly sources. Moreover, the autocorrelation function (ACF) and partial autocorrelation function (PACF) have allowed the researchers to assess the stability of the accounting data. All study variables and all quarters of the financial data were judged to be stable by the researchers; hence, the data is deemed stable and the difference will be assumed to be zero in order to create the ARIMA model. As a consequence, Tables 3 and 4 present the researchers' findings from the ARIMA model.

Table 3: Using the ARIMA model to analyze (fixed asset) in both traditional and adjusted balance sheets for the period of research (each quarter represents the average of the quarters in the 11 years)

Quarter	ARIMA	FA	TFA	RCEFA
First	(1,0,0)	60.650	48.960	15.970
	(1,0,1)	57.450	49.420	16.270
	(0,0,1)	54.770	48.050	15.680
	(1,0,2)	57.380	49.700	15.300
	(2,0,2)	62.140	55.070	16.260
Second	(1,0,0)	92.730	67.990	26.170
	(1,0,1)	96.590	68.650	25.480
	(0,0,1)	93.570	68.810	26.200
	(1,0,2)	84.790	59.260	28.530
	(2,0,2)	91.340	64.030	29.440
Third	(1,0,0)	75.650	57.200	20.510
	(1,0,1)	77.860	59.480	20.010
	(0,0,1)	75.660	57.220	20.510
	(1,0,2)	83.220	61.770	20.810
	(2,0,2)	84.900	63.740	21.260
Fourth	(1,0,0)	33.590	28.080	12.610
	(1,0,1)	31.100	28.910	12.230
	(0,0,1)	29.290	27.310	12.170
	(1,0,2)	32.210	30.960	11.560
	(2,0,2)	34.580	31.340	11.880

Table 4: Using the ARIMA model to analyze (intangible assets) in both traditional and adjusted balance sheets (each quarter represents the average of the quarters in the 11 years)

Quarter	ARIMA	IA	TIA	CA	CO
First	(1,0,0)	79.960	63.770	8.330	12.300
	(1,0,1)	84.810	66.640	8.510	13.040
	(0,0,1)	79.970	63.700	8.090	12.490
	(1,0,2)	87.210	70.190	8.860	13.800
	(2,0,2)	86.820	64.760	9.620	15.050
Second	(1,0,0)	101.650	86.100	5.810	14.730
	(1,0,1)	106.900	88.900	5.770	15.600
	(0,0,1)	101.860	86.570	5.800	15.010
	(1,0,2)	87.670	74.540	6.130	16.090
	(2,0,2)	92.540	80.400	5.460	15.240
Third	(1,0,0)	81.870	79.240	6.050	7.110
	(1,0,1)	82.200	79.770	6.350	6.800
	(0,0,1)	78.080	75.850	6.210	6.470
	(1,0,2)	82.930	79.610	6.590	7.260
	(2,0,2)	80.130	86.550	7.010	7.300

Fourth	(1,0,0)	74.780	67.570	5.650	15.290
	(1,0,1)	79.240	71.530	5.760	15.800
	(0,0,1)	75.520	67.480	6.450	15.260
	(1,0,2)	79.830	76.380	6.160	16.890
	(2,0,2)	83.910	81.340	6.650	18.410

The value of R2 may be determined by selecting and using the best models for the study variables, as indicated in Tables 5 and 6.

Table 5: The value of R^2 for fixed assets based on the ARIMA model's findings

	First	Second	Third	Fourth
FA	0.110	0.080	0.160	0.090
TFA	0.130	0.100	0.190	0.110
RCEFA	0.020	0.110	0.070	0.010

Table 6: The value of R^2 for intangible assets based on the ARIMA model's findings

	First	Second	Third	Fourth
IA	0.190	0.310	0.200	0.240
TIA	0.220	0.320	0.230	0.260
CA	0.120	0.110	0.090	0.090
CO	0.110	0.280	0.050	0.150

Tables 5 and 6 show that as compared to other variables, the values of R^2 for conventional intangible and fixed assets have grown. This entails lowering uncontrollably occurring outside factors, raising accuracy levels in the process.

2.3.1.2 CV of Accounting Information:

The researchers analyzed CV of the financial data related to carbon emissions contained in both the traditional and adjusted income statements of the research sample firm within the research time limits using the information content model (ICM), the most suitable model for this research. Mathematics is used to demonstrate this paradigm in Equation 2.

$$\text{ICM} = \frac{(\text{P} - \text{E})}{\text{P}} \qquad (2)$$

Where:
P = the firm's share's market price(it can be seen on the official website of the company)
E = The share's anticipated price based on accounting data

In addition to daily and weekly share prices in the financial markets (opening, closing, maximum, and minimum), the researchers also used quarterly data, which they translated on a quarterly basis for the same years, as Table 7 illustrates.

Table 7: CV of accounting information related to traditional and adjusted income statements

Quarter	TAI	AAI
1st	-4561.68	-4561.68
2nd	-4742.26	-4742.26
3rd	-4539.54	-4539.54
4th	-4648.25	-4648.25

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Table 7 demonstrates that FRCE had no influence on CV, a sub-characteristic of RAI, since the statistical analysis's findings by implementing Equation 2 on the accounting information related to traditional and adjusted income statements indicated that FRCE had no effect over the research period.

2.3.1.3 Materiality of Accounting Information:

As indicated in Tables 8–12, the researchers employed relevant statistical techniques to analyze the MT of accounting data for every accounting piece in the research sample firm's traditional and adjusted financial statements both during the research period and on a quarterly basis.

Table 8: MT of fixed assets

Quarter	TFS		AFS	
	FA	FA related to CE	TFA	FA related to CE
First	0.324	-	0.257	0.067
Second	0.319	-	0.251	0.068
Third	0.327	-	0.258	0.069
Fourth	0.323	-	0.256	0.068

As can be shown in Table 8, for every quarter during the research period, the MT of fixed assets connected to carbon emissions in the conventional financial statement is zero. However, in the adjusted financial statement, this MT is raised to be between 0.067 and 0.069.

Table 9: MT of intangible assets

Quarter	TFS		AFS		
	IA	IA related to CE	TIA	CA	CO
First	0.357	-	0.297	0.024	0.035
Second	0.353	-	0.296	0.022	0.034
Third	0.351	-	0.294	0.023	0.032
Fourth	0.356	-	0.297	0.024	0.035

The adjusted financial statement displays the MT of intangible assets related to carbon emissions as carbon allowances and carbon offsets, which grew to be in the range of 0.032 and 0.035. Table 9 shows that for every quarter of the study period, the MT of intangible assets associated with carbon emissions in the conventional financial statement is 0.

Table 10: MT of operational and depletion costs

Quarter	TFS		AFS	
	O. and D. Costs	O. and D. Costs related to C.E.	T. O. and D. Costs	O. and D. Costs related to C.E.
First	2.453	-	2.049	0.404
Second	1.339	-	1.124	0.215
Third	1.605	-	1.333	0.272
Fourth	1.949	-	1.626	0.323

Table 10 demonstrates that the MT of depletion and operating expenses related to carbon emissions in the traditional financial statement is zero for each quarter of the research period. On the other hand, the adjusted financial statement raises the MT of these expenses to be between 0.215 and 0.404.

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Table 11: MT of other expenses

Quarter	TFS		AFS	
	O.E.	O.E. related to C.E.	T.O.E.	O.E. related to C.E.
First	0.235	-	0.177	0.058
Second	0.124	-	0.092	0.032
Third	0.159	-	0.121	0.038
Fourth	0.183	-	0.139	0.044

Table 11 illustrates that, for every quarter of the research period, the MT of additional expenditures connected to carbon emissions in the conventional financial statement is zero. However, in the adjusted financial statement, this MT is raised to be between 0.032 and 0.058.

Table 12: MT of income tax expenses

Quarter	TFS		AFS	
	I.T.E.	I.T.E. related to C.E.	T.I.T.E.	I.T.E. related to C.E.
First	0.856	-	0.799	0.057
Second	0.487	-	0.455	0.032
Third	0.577	-	0.541	0.036
Fourth	0.695	-	0.653	0.042

Table 12 illustrates that for every quarter of the research period, the MT of income tax charges associated with carbon emissions in the conventional financial statement is zero. However, in the adjusted financial statement, this MT is raised to be between 0.032 and 0.057.

3.Discussion of Results :

According to the findings of the stability test, every significant variable was stable at the zero-difference level. As a result, the financial statements' PV was evaluated using the ARIMA model. It was clear from using the ARIMA model that, when compared to other related variables, the R2 values for traditional fixed assets and traditional intangible assets rose. This suggests a decrease in external factors that are outside our control and, as a result, an improvement in PV accuracy. However, the research sample firm's income statements did not show any impact from the introduction of carbon emissions financial reporting when it came to CV of accounting information. This demonstrates that there isn't a direct correlation between the factors under investigation. Additionally, the statistical research showed that the amended financial accounts provide more complete information and that the MT of the connected variables fluctuates dramatically. This is explained by the firm's concentration in its prior reports on pertinent financial data disclosures about carbon emissions.

3.1 FRCE enhances PV of accounting information:

The research sample firm's financial data underwent statistical analysis, which showed that FRCE improves PV correctness of accounting data. A statistically significant link is implied by this. Thus, the first hypothesis is accepted by the researchers.

3.2 FRCE enhances CV of accounting information:

According to a statistical examination of the research sample firm's financial data, FRCE has no effect on the accuracy of accounting information on a CV. Because of this, the researchers conclude that there isn't a statistically significant association and reject the second hypothesis.

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3.3 FRCE enhances MT of accounting information:

The relative RAI is impacted by FRCE, according to a statistical study of the research sample firm's financial data. Since this suggests a statistically significant link, the third hypothesis is accepted by the researchers. Overall, the study's primary hypothesis—that FRCE influences RAI quality—is accepted by the researcher.

4.Conclusion:

The inclusion of accounting information related to carbon emissions not only meets user requirements for financial data but also aligns with environmental preservation mandates, elevating the status of environmental accounting. Achieving transparency in reporting is pivotal, enabling users to comprehend the firm's role in mitigating or contributing to carbon emissions. This understanding empowers users to make informed decisions, assessing the accounting information's impact on the firm's value, compliance with legal regulations, and alignment with public demands for environmental conservation. Beyond evaluating the firm's environmental performance, foundational accounting information for Financial Reporting on Carbon Emissions (FRCE) should encompass reporting on environmental policies, providing a comprehensive overview of environmental initiatives, disclosing improvements, and establishing clear environmental goals. To meet local or international regulations on carbon emissions, the accounting information must extend to include financial reporting on expenses associated with carbon emissions. The Relevance of Accounting Information (RAI) is intricately linked to FRCE programs and greenhouse gas emissions, influencing the overall quality of financial reporting. Enhancing the suitability of this information through FRCE contributes significantly to elevating the standard of financial reporting for the firm, fostering transparency and sustainability in its disclosures.

Authors Declaration:

Conflicts of Interest: None

-We Hereby Confirm That All The Figures and Tables In The Manuscript Are Mine and Ours. Besides, The Figures and Images, Which are Not Mine, Have Been Permitted Republication and Attached to The Manuscript.

- Ethical Clearance: The Research Was Approved By The Local Ethical Committee in The University.

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دور الإبلاغ المالي عن انبعاثات الكربون في تعزيز خاصية الملاءمة للمعلومات المحاسبية

سنى طعمة خضير[1]
جامعة بغداد / كلية الإدارة والإقتصاد / قسم المحاسبة
بغداد، العراق
sanatuama@gmail.com

لبنى زيد إبراهيم[2]
جامعة بغداد / كلية الإدارة والإقتصاد / قسم المحاسبة
بغداد، العراق
drlobna@coadec.uobaghdad.edu.iq

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مستخلص البحث:

في محاولة لتعزيز قابلية استخدام البيانات المحاسبية لشركات النفط العالمية التي تعمل في العراق، تتناول هذه الدراسة دور الإبلاغ المالي حول انبعاثات الكربون. إذ قامت الباحثتان باستكشاف المفهوم الشامل وأهمية ملاءمة المعلومات المحاسبية بشكل عام، مع التركيز الخاص على تطبيقها على المعلومات المحاسبية المتعلقة بانبعاثات الكربون. كما تناولت الدراسة أيضا الأبلاغ المالي حول انبعاثات الكربون في الشركات الصناعية. وباستخدام نموذجين رياضيين، وهما نموذج محتوى المعلومات (ICM) والنموذج المتكامل المتحرك للمتوسط (ARIMA)، قامت الباحثتان بتحليل عميق لقوائم البيانات المالية لمدة أحد عشر عاما لشركة دانا غاز، التي تشكل أساس عينة هذه الدراسة. ولقد تم أداء التحليل باستخدام برنامج SPSS. أظهرت الدراسة عدة استنتاجات من ضمنها الاكتشاف الرئيسي المتمثل في أن ضمان ملاءمة المعلومات المحاسبية المتعلقة بانبعاثات الكربون يتماشى مع متطلبات المستخدمين للمعلومات المحاسبية وضروريات الحفاظ على البيئة. علاوة على ذلك، تسلط الدراسة الضوء على تأثير التقارير المالية حول برامج انبعاثات الكربون وانبعاثات الغازات الدفيئة على ملاءمة المعلومات المحاسبية، مما يؤثر بالتالي على الجودة العامة للتقارير المالية. وتبرز الدراسة أن تعزيز ملاءمة المعلومات من خلال الإبلاغ المالي حول انبعاثات الكربون يسهم بشكل كبير في رفع مستوى جودة التقارير المالية للشركة. وكتوصية تدعو الباحثتان إلى الامتثال للقوانين المحلية أو المعاهدات الدولية التي تنظم انبعاثات الكربون، مع التأكيد على ضرورة تضمين معلومات محاسبية وتقارير مالية تفصيلية حول المصاريف المتعلقة بانبعاثات الكربون في هذه الجهود للامتثال.

نوع البحث: ورقة بحثية

المصطلحات الرئيسة للبحث: الإبلاغ المالي، انبعاثات الكربون، ملاءمة المعلومات المحاسبية, الأهمية النسبية، القيمة التأكيدية، القيمة التنبؤية.

* بحث مستل من رسالة ماجستير