




# “Carbon accounting, management quality, and bank performance in East Africa”

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# CARBON ACCOUNTING, MANAGEMENT QUALITY, AND BANK PERFORMANCE IN EAST AFRICA

## Abstract

Does it pay to report green activities? This question has dominated academic discussion and has further spiraled into the industry. Questions exist about the value relevance of carbon accounting, given that such practice is voluntary and consumes resources. The question becomes more legitimate when banks whose activities do not negatively affect the environment adopt carbon accounting. Given this perplexing phenomenon, the study examined the impact of carbon accounting on the performance of banks in East Africa. Moreover, the effect of management quality on such a relationship was analyzed. The study relied on eight years of integrated, sustainability, and annual reports of 79 banks in East Africa, collecting the carbon accounting data. A multiple regression estimation technique was employed to estimate the models. The study demonstrated that carbon reporting had a negative and insignificant relationship with the financial performance of banks. In addition, the study showed that management quality turned the relationship between carbon disclosure and firm performance positive, suggesting that the banks with high quality of management benefited financially from carbon reporting. The study concludes that carbon accounting does not benefit East African banks. However, banks that had high quality of management financially benefited from carbon accounting. The significant implication of these results is that banks can benefit from adopting carbon accounting but only when they have high management quality. This study contributes to the debate on the conflicting empirical findings on the value relevance of carbon accounting in Africa, which is scarce.

## Keywords

environmental accounting, carbon accounting, green accounting, integrated reporting, sustainability reporting, value relevance, management quality

## JEL Classification

M14, M40, M41

## INTRODUCTION

The activities of firms have been under scrutiny because of their harmful impacts on the environment. As a result, firms were called upon to be responsible toward the environment by avoiding activities with negative environmental impacts. This call is timely because climate change, the degradation of the ecosystem, and the loss of biodiversity are not merely the result of a global industrial system but intrinsically involves how the industrial system was established, managed, and financed (Steininger et al., 2016; Sial et al., 2021). This requires modifying the prevailing methods of production and consumption patterns to address the harm caused to the environment; otherwise, the world may reach unsustainable growth (Maama et al., 2020).

In the past three decades, climate change has dominated discussion on the six major sustainability problems in the world, including loss of biodiversity, deforestation, poverty, overpopulation, and the scarcity of potable water. Perhaps, climate change is the most critical issue among the six major sustainability issues (Csutora & Harangozo,

2017; Keith et al., 2019). Myriads of scientific evidence demonstrate that climate change poses grave challenges (He et al., 2016; Gibassier et al., 2020). Climate change, if not controlled, can lead to global warming, which can cause severe damage to the world. However, in recent times, firms have appeared to congregate in a more constructive position that sees climate change as an opportunity rather than a responsibility (Bui et al., 2020; Tuesta et al., 2021). This is reasonable because businesses have realized that financial markets and investors reward firms moving toward climate change while abstaining from those that lag behind (Kolk et al., 2008).

Investors and other stakeholders are pushing firms to disclose information about their carbon activities because carbon disclosures provide information valuable to a reliable valuation of assets. A reporting practice where firms provide information about their carbon activities is called carbon accounting (Albers et al., 2020; Marlowe & Clarke, 2022). Through carbon accounting, firms discharge their environmental and social accountability to stakeholders. With this recognition, many firms provide information about their carbon activities through carbon reporting. Such information is primarily contained in annual, integrated, or sustainability reports. However, efficient and accurate carbon reporting can be demanding for firms, requiring extra effort and resources. Accounting for carbon activities also requires quantifying firms' direct and indirect activities, which exerts enormous pressure on firms.

The extant literature provides inconsistent evidence on whether environmentally responsible and accountable activities are linked with improved performance (He et al., 2016; Sharma et al., 2019; Tuesta et al., 2021). This question is particularly relevant to the banking industry, whose activities are not known to impact the environment negatively. It is, therefore, crucial to investigate whether banks benefit from providing information about their carbon activities. Apart from answering this question, it is also curious to find whether firms' benefit of carbon accounting is conditional to the quality of management managing their resources. This suggests that for a firm to benefit from carbon accounting fully, it must also have quality management to balance spending resources on carbon issues and reaping benefits from such activities.

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## 1. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Researchers have shown considerable interest in the impact of firms' activities on the environment and biodiversity. This has brought a heightened focus on carbon accounting. Ong et al. (2021) define carbon accounting as the measurement, recording, and communication of firms' carbon activities in a way that enables the measurement and monitoring of carbon emissions to motivate better performance. Carbon accounting can also be described as measuring a firm's carbon emissions, collecting such data, and reporting the information to internal and external stakeholders of firms (Bowen & Wittneben, 2011; Borghei, 2021).

Carbon accounting mainly aims to moderate firms' carbon trajectory by measuring and monitoring their emission levels (Stechemesser &

Guenther, 2012; Ascui, 2014; Gibassier et al., 2020). This suggests that for a firm to implement carbon accounting practice effectively, it must understand the need to mitigate carbon dioxide (CO<sub>2</sub>) emissions, in addition to the factors that affect a certain quantity of emissions. Furthermore, the degradation of the environment triggered by carbon emissions by the activities of firms threatens the ecosystem (Beeler & Panter, 2018; Bui & Fowler, 2019; Marlowe & Clarke, 2022). This makes carbon accounting an essential tool because it offers a mechanism to quantify carbon emissions and assist firms in making informed decisions about mitigation strategies. In this way, the information generated by carbon accounting can improve carbon performance superiority (Kasbun et al., 2019; Ong et al., 2021).

The evolution and initiation of carbon accounting practice and research are harmonized with the development of global carbon institutions (He et al., 2020). Carbon accounting studies take root from

the European Union (EU) Commission Trading Scheme (ETS) and the Kyoto Protocol. These important events increased the awareness of the need to address climate change (Hartmann et al., 2013; He et al., 2020; Brander et al., 2021). Accounting for the firms' climate change or carbon activities was seen as the main driver in addressing the challenges posed by the operations of firms (Maama, 2021). In some firms, carbon accounting was/is considered a component of environmental and social responsibility accounting (Stechemesser & Guenther, 2012; Ascui, 2014; Velte et al., 2020). However, an upsurge in the literature on the topic demonstrates that it is progressively evolving into a standalone field of study in accounting. Historically, research on carbon accounting can be traced back to Freedman and Jaggi's (2005) publication. After their publication, many empirical and conceptual studies have been published in accounting journals to offer opinions, insights, and evidence on carbon accounting. Carbon accounting remains voluntary in many parts of the world. However, some firms have voluntarily provided information regarding their carbon activities to their stakeholders.

In terms of countries' contribution toward adopting carbon accounting, special mention should be made of South Africa and the United Kingdom. Through the introduction of the King III Code of Corporate Governance, all listed firms in South Africa were mandated to provide integrated reports detailing, among other things, how their activities influence society and the environment (Wachira et al., 2020; Corvino et al., 2020). By providing information about how their activities affected the environment, the firms in South Africa included information about their carbon activities. In addition, the UK Government updated its Environmental Reporting Guidelines in 2013, which included energy and carbon reporting. The Guideline also outlined additional voluntary information potentially valuable for various stakeholders and organizations (Ready, 2014).

Similarly, the contributions of the Climate Disclosure Standards Board (CDSB) to the development, adoption, and practice of carbon accounting are far-reaching. The CDSB is a global group of firms and environmental non-governmental organizations (NGOs) committed to developing

and aligning the international conventional reporting framework to connect financial capital with natural capital. The main aim of the CDSB is to promote climate change-related disclosure in conventional reports through the development of an international framework for corporate reporting on climate change (Thistlethwaite, 2015). The CDSB achieves this by providing a framework for reporting carbon and climate change information with similar commitment and rigor as financial information.

Issues dominating the adoption of carbon accounting are centered around the motivation of management and whether it benefits the firms that adopt it. Questions have been asked about whether carbon accounting has a direct impact on the performance of firms. Authors have provided conflicting results on this matter, empirically and theoretically. This study uses agency theory to explain that carbon accounting would positively affect the performance of banks in East Africa. The agency theory holds that the segregation of power between management and owners of a firm generates agency costs. The agency cost arises because of a conflict of interest between agents (management) and their principals (owners), where management may place their interests ahead of those of the owners (Guping et al., 2020). This conflict is detrimental to the prospect of firms because, in most cases, it results in a trade-off between long-term and short-term objectives. To signal that the agency problem does not exist, management provides non-financial information, which is mostly voluntary, to suggest that they manage the firms in the best interests of their stakeholders (Vitolla et al., 2020; Cherian et al., 2020). The stakeholders would see this act by management as a sign of good intentions, hence would have confidence in them. This study, therefore, postulates that the management of banks can use carbon accounting to influence the behavior of their stakeholders. This will positively influence financial performance because socially responsible investors and consumers will patronize their shares and services.

The majority of extant studies focused on the impact of non-financial information on the performance of firms. The non-financial information primarily focused on environmental accounting, integrated reporting, social responsi-

bility accounting, and sustainability reporting. Nonetheless, few of these studies concentrated on the impact of carbon accounting on the performance of firms across the globe. However, most empirical evidence confirms that carbon accounting influences firms' financial performance. For instance, Tuesta et al. (2021) explored the association between carbon management accounting and the financial performance of selected European companies. By applying a multiple regression estimation technique on a dataset from 350 firms, the study confirmed that carbon accounting is positively related to financial performance, suggesting that carbon accounting is beneficial to firms.

Andrian (2010) found similar results in a study that examined the impact of carbon disclosure on the financial performance of listed companies on the Indonesia Stock Exchange. The study showed that carbon disclosure positively and significantly impacts the financial performance of listed Indonesian firms. Using the cost of equity as a measure of financial performance, Bui et al. (2020) also showed that carbon disclosure negatively relates to the cost of capital. This result implies that carbon disclosure can help firms reduce the premium investors require to compensate for their poor carbon performance. In a related study, Saka and Oshika (2014) investigated the impact of carbon emission disclosure on corporate value using a dataset from Japanese firms. The study demonstrated that carbon emission has a negative impact on the value of firms. However, the disclosure of carbon management positively influenced the firms' market value, suggesting that firms can use carbon reporting to increase their market value.

Several other prior studies, such as those of Ali et al. (2019), Saini and Singhania (2019), and Bui et al. (2020), also support the view that there is a positive relationship between non-financial information disclosure (including carbon accounting) and the performance of firms. This means that stakeholders cannot recognize the carbon management activities of firms if they do not make such information publicly available. Stakeholders can make effective decisions based on such information by making their carbon activities available. Furthermore, such disclosures positively influence the performance of firms because, in most parts, the firms tend to disproportionately provide posi-

tive carbon information, as opposed to damaging information (Ong et al., 2021). This observation is consistent with the legitimacy theory, which holds that firms report positive carbon information to influence the decision-making process of stakeholders. On the other hand, scientific evidence provided by Cardebat and Sirven (2010) and Sharma et al. (2019) demonstrated that the disclosure of voluntary non-financial information negatively impacts firms' financial performance.

It is evident from the preceding discussion that there are conflicting results on the relationship between carbon accounting and the performance of firms. This study postulates that the relationship between carbon accounting and the performance of banks would not exist in a vacuum. The paper argues that for a firm to benefit from carbon accounting positively, it must have good management. This suggests that the quality of management would influence the relationship between carbon accounting and the performance of banks. Some studies provide evidence to suggest the reasonableness of this assumption. Solikhah et al. (2021) examined how corporate governance principles influence the relationship between media coverage, environmental award, and financial performance, on one side, and environmental disclosure quality. By employing a partial least square structural equation modeling, the authors documented that corporate governance principles improved the relationship among the variables. This suggests that implementing quality management practices can influence the relationship between carbon accounting and firms' performance. Similarly, Ali et al. (2019) demonstrated that ownership structure moderates the association between corporate social responsibility disclosure and the performance of firms. In a study conducted in China, Bai and Chang (2015) also showed that marketing competence resulting from quality management mediates the relationship between corporate social responsibility and firm performance.

Albitar et al. (2020) demonstrated that the relationship between environmental, social, and governance disclosure and firms' performance is affected by the quality of corporate governance mechanisms. Pham and Tran (2020) confirmed the results of previous studies by proving that the integrity of a firm's CEO strengthens the positive impact of corporate social responsibility reporting

on the performance of firms. The literature consensus appears that firms that provide information about their carbon footprints benefit financially. The evidence implies that greater disclosure of a firm's carbon activities engenders greater investors' and customers' awareness, resulting in a more significant investor and customer base. It is also evident from the literature that quality management strengthens the relationship between carbon accounting and firms' performance. However, there is scarce evidence of the impact of carbon accounting on the financial performance of banks in East Africa. The aim of this study is to examine the relationship between carbon accounting and banks' performance in East Africa and further assess how management quality can influence this relationship. Therefore, the study contributes to understanding the value relevance of carbon accounting in East Africa. Based on this evidence, the study formulates the following hypotheses:

- H1: *Carbon accounting positively impacts banks' return on capital employed (ROCE).*
- H2: *Management quality influences the relationship between carbon accounting and return on capital employed.*
- H3: *Carbon accounting positively influences banks' net interest margin (NIM).*
- H4: *Management quality influences the relationship between carbon accounting and net interest margin.*

## 2. DATA AND METHODS

The study involved 79 banks from four countries in East Africa, including Kenya, Tanzania, Uganda, and Rwanda. The study relied on the integrated, sustainability, or annual reports and financial data of banks operating in the East African Community. Preference was given to data contained in the integrated or sustainability reports. However, only 43 banks provided standalone integrated or sustainability reports. The other 36 banks provided only annual reports. Hence, the study relied on 43 integrated or sustainability reports and 36 annual reports for the carbon accounting data. The other financial data were ob-

tained from the Bloomberg database. In addition, the data on management quality was obtained from the database of the World Economic Forum.

The study covered a period of 7 years, from 2014 to 2020. 2014 was chosen as the base year because it is the year immediately following the introduction of the Sustainability Reporting Guidelines by the Global Reporting Initiative and the Integrated Reporting Framework, which was also introduced by the International Integrated Reporting Council. These two reporting frameworks offer detailed guidelines to firms on integrating carbon accounting into their reporting practices. The year 2020 was the terminating year because it is the year with the latest available reports from the firm. A total of 553 reports were used for the study.

The study developed an econometric model to estimate the interrelationship between carbon accounting, management quality, and firm performance. The estimation was based on a multiple regression technique, involving fixed effect and random effect regression models. The econometric models were developed following Datt et al. (2019), Alsaifi et al. (2020), and Bui et al. (2020). Models 1 and 3 estimate the impact of carbon accounting (CADS) on return on capital employed (ROCE) and net interest margin (NIM), respectively. Again, models 2 and 4 are developed to examine the influence of management quality on the relationship between CADS, on the one hand, and ROCE and NIM, respectively.

$$ROCE_{it} = \beta_0 + \beta_1 CADS_{it} + \beta_2 MgtQ_{it} + \beta_3 AuditQ_{it} + \beta_4 EcoSize_{it} + \beta_5 FSize_{it} + \beta_6 FAge_{it} + \varepsilon_{it}, \quad (1)$$

$$ROCE_{it} = \beta_0 + \beta_1 CADS_{it} + \beta_2 MgtQ_{it} + \beta_3 CAD \cdot MgtQ_{it} + \beta_4 AuditQ_{it} + \beta_5 EcoSize_{it} + \beta_6 FSize_{it} + \beta_7 FAge_{it} + \varepsilon_{it}, \quad (2)$$

$$NIM_{it} = \beta_0 + \beta_1 CADS_{it} + \beta_2 MgtQ_{it} + \beta_3 AuditQ_{it} + \beta_4 EcoSize_{it} + \beta_5 FSize_{it} + \beta_6 FAge_{it} + \varepsilon_{it}, \quad (3)$$

$$NIM_{it} = \beta_0 + \beta_1 CADS_{it} + \beta_2 MgtQ_{it} + \beta_3 CAD \cdot MgtQ_{it} + \beta_4 AuditQ_{it} + \beta_5 EcoSize_{it} + \beta_6 FSize_{it} + \beta_7 FAge_{it} + \varepsilon_{it}. \quad (4)$$

The variables in the models are explained as follows:  $ROCE_{it}$  signifies return on capital employed of  $i$  at time  $t$ . This variable was measured by the percentage of profit after tax to the total assets of the firms.  $NIM_{it}$  represents the net interest margin of the banks, measured as the ratio of the banks' net returns to the earning assets.

$CADS_{it}$  denotes the carbon accounting disclosure score of a firm  $i$  at time  $t$ . The carbon accounting disclosure was measured based on a dichotomous response, taking a value of 1 for a firm that reports its carbon activities and 0 otherwise.  $MgtQ_{it}$  represents the management quality of a country  $i$  at time  $t$ . Management quality was measured based on the World Economic Forum metric for measuring the extent to which firms in a specific country rely on professional management. It ranges from 1 to 7, where 1 represents poor management quality and 7 denotes high management quality.

$AuditQ_{it}$  is the audit quality of a firm  $i$  at time  $t$ . The audit quality was measured by the Big4 auditing firms. A dummy variable of 1 represents a firm audited by one of the top four auditing firms, comprising KPMG, Ernst and Young, PwC, and Deloitte. Zero is also used to represent firms not audited by one of the top 4 auditing firms.  $EcoSize_{it}$  is the economic size of the countries where the firms operate. The economic size was measured by the natural logarithm of the countries' gross domestic product (GDP).  $FSize_{it}$  is the size of the firms, measured by the natural logarithm of the total assets of the firms.  $FAge_{it}$  is the number of years a bank had been in operation at time ' $t$ '.  $\beta$  represents the coefficients of the variables,  $\epsilon_{it}$  is the stochastic error term at time ' $t$ ', ' $i$ ' is the number of firms, and ' $t$ ' is the time period.

### 3. RESULTS AND DISCUSSION

#### 3.1. Summary statistics

The study investigated whether carbon accounting (CADS) influenced the financial performance of banks in East Africa. Two performance measurement metrics (ROCE and NIM) were used as proxies for financial performance. Similarly, the study examined whether quality management moderated the relationship between CADS and banks' performance. Before the study reports the coefficients of the variables in the model, the descriptive statistics are first shown in Table 1.

The results show that the average ROCE of the banks was 9.174. In addition, the result indicates that the average NIM of the banks was 13.85%, which suggests that, on average, the return of the listed firms represents 13.85% of the earning assets. The results also indicate that the carbon accounting disclosure score (CADS) had a mean value of 0.37, suggesting that, on average, banks provided weak disclosures on their carbon activities. The standard deviation of the CADS was 0.14, signifying less variation among the firms in their CADS practices.

A look at the other variables tells that management quality (MgtQ) and audit quality (AudQ) obtained mean scores of 4.02 and 0.52, respectively. These findings suggest that, on average, firms in East Africa did not have quality management. Similarly, the result indicates that slightly more than half of the banks were audited by one of the Big 4 auditing firms, indicating a quality audit. The evidence further shows that, on average, the size of firms was USD 63.17 million. A standard deviation of 36.04 suggests a wide variation among the firms concerning their size. This result is reasonable because of the wide variety of banks operating in East Africa.

**Table 1.** Summary statistics

Variables	Observation	Mean	Std. dev.	Maximum	Minimum
ROCE (%)	553	9.74	3.07	23.84	5.91
NIM (%)	553	13.85	5.24	41.63	8.16
CADS	553	0.37	0.14	1.00	0.00
MgtQ	553	4.02	1.48	5.31	3.04
AuditQ	553	0.52	0.26	1.00	0.00
EcoSize (\$m)	553	41.78	23.96	98.84	6.88
FSize (\$m)	553	63.17	36.04	317.93	25.71
FAge	553	24	19	64	13

**Table 2.** Correlation matrix and VIF

Variables	CADS	MgtQ	AuditQ	EcoSize	FSize	FAge	VIF
CADS	1.000	–	–	–	–	–	2.269
MgtQ	0.418***	1.000	–	–	–	–	1.602
AuditQ	0.529**	0.248***	1.000	–	–	–	3.824
EcoSize	0.036**	0.109**	0.153*	1.000	–	–	2.977
FSize	0.197*	0.271***	0.502	0.194***	1.000	–	2.832
FAge	0.328***	0.014***	0.284***	0.302***	0.373**	1.000	3.619

Note: \*\*\* = significant at 0.01; \*\* = significant at 0.05; and \* = significant at 0.1.

### 3.2. Test of multicollinearity

The independent variables in the model were subjected to a multicollinearity test to determine whether any pair of the variables were highly correlated. Table 2 presents the correlation matrix and the VIF of the variables in the models.

The multicollinearity test results indicate weak relationships among the explanatory variables. This is demonstrated by the low correlation coefficients presented in Table 2. The correlation coefficients among the other independent variables are less than 0.60. The VIF results of these variables further suggest no multicollinearity issues because the VIF values range from 1.602 and 3.824, which are significantly lower than the threshold value of 10.

## 4. REGRESSION RESULTS

The study performed regression analyses based on four models. Model 1 examined the impact of the CADS on the ROCE, while model 2 looked at how management quality moderated such relationships. Model 3 also assessed the impact of CADS on NIM, and model 4 investigated whether management quality influenced the relationship between CADS and NIM.

Table 3 presents the results from the analyses. It contains the coefficient of the variables, the t-values (in parenthesis), and the coefficient level of significance represented by asterisks. Following the results of the Hausman tests, a random effect estimation technique was adopted. The Hausman tests provide insignificant ( $p > 0.05$ ) results for all the models. These results fail to reject the null hypothesis of the existence of time-specific variations data, hence the adoption of the random effect estimation technique.

**Table 3.** Regression results

Variables	Model 1	Model 2	Model 3	Model 4
Constant	3.4612*** (5.275)	5.1424*** (6.629)	1.0941*** (8.732)	1.4073*** (6.954)
CADS	-0.2215 (-1.354)	0.1437** (1.984)	-0.1516* (-1.874)	0.0257*** (3.072)
MgtQ	0.2162* (1.892)	0.0883* (1.794)	0.1185** (2.131)	0.1631*** (3.991)
CADS-MgtQ	–	0.2072*** (3.105)	–	0.1827** (2.196)
AuditQ	0.0915 (1.089)	0.0728** (2.017)	0.1209 (1.0823)	0.1923* (1.931)
EcoSize	0.0873 (1.067)	0.2286 (1.195)	0.0595 (1.139)	0.1107 (1.185)
FSize	0.0887* (1.794)	0.1278** (2.135)	0.0807** (3.394)	0.1448*** (2.782)
FAge	0.0273* (1.895)	0.2319** (2.137)	0.1186** (1.983)	0.1105 (1.295)
R-squared	0.8937	0.9254	0.8618	0.9025
Adjusted R-squared	0.8491	0.8709	0.8562	0.8845
F-statistic	293.02	197.97	153.28	93.48
Prob (F-statistic)	0.000	0.000	0.000	0.000
Prob. of Hausman Test	0.2836	0.1971	0.1708	0.2124
Durbin-Watson stat	0.3609	0.2814	0.1726	0.2517

Note: \*\*\* = significant at 0.01; \*\* = significant at 0.05; and \* = significant at 0.1.

The result presented in Table 3 shows that CADS has a negative but insignificant ( $p > 0.05$ ) impact on ROCE. Thus, banks that disclose carbon information do not benefit from increased ROCE. We further found an inverse and insignificant ( $p > 0.05$ ) relationship between CADS and NIM, suggesting that carbon accounting negatively affects the NIM of banks. These results suggest that the disclosure of voluntary carbon information does not reflect in the positive financial performance of firms. Although these results were not expected, they make sense in the following ways. First, banks' operations are not known to have a negative impact on society and the environment. As a result, there may be little or no expectations from their stakeholders to provide such information.



Meanwhile, providing information on carbon activities adds to the banks' costs. In this case, if stakeholders do not reward the banks for reporting their carbon activities, it would have a negative impact on their bottom line.

Another reason for a negative relationship between carbon accounting and the performance of the banks is that the stakeholders may see the carbon reporting activities of the banks as a smokescreen intended to conceal some adverse developments about their operations. This perception will breed skepticism and suspicion among the stakeholders. Thus, instead of rewarding the firms for reporting their carbon activities, they would punish them for a perceived deception. In addition to the above reasons, the banks may benefit from carbon reporting, but the benefits may not justify the cost of reporting that information. This would make the net effect of carbon accounting to be negative. Surprisingly, the negative relationship between CADS and firm performance is consistent with the findings of Sharma et al. (2019). They demonstrated that carbon accounting practice negatively correlates with firms' performance. Conversely, these results are inconsistent with Andrian (2010), Saka and Oshika (2014), Tuesta et al. (2021), and Bui et al. (2020), who provided evidence that carbon accounting has a positive influence on the performance of firms.

The study hypothesized that quality management could moderate the relationship between CADS and ROCE. The result presented in model 2 shows that management quality significantly mediates the relationship between CADS and ROCE. Confirming the prediction, the coefficient of the moderating variable (CADS · MgtQ) is positive and significant. In addition, the coefficients of CADS in models 2 and 4 have turned positive. This confirms that firms with quality management benefit from improved ROCE and NIM. In economic terms, the result suggests that quality management results in a higher ROCE and NIM when firms adopt carbon accounting practices.

The study further regressed management quality (MgtQ) against ROCE and NIM. The findings show that MgtQ has a positive impact on the ROCE. Similar results were found in models 3 and 4, where the coefficients of MgtQ are posi-

tive. Contrary to the study's expectation, the level impact of MgtQ on ROCE is statistically insignificant in models 1 and 2, suggesting that ROCE of firms is not influenced by the quality of management possessed by the firms. On the other hand, MgtQ has a positive and significant relationship with NIM, implying that firms with quality management would improve their NIM.

Specific important implications flow from these results. First, carbon reporting does not automatically reflect improved financial performance because it involves cost. In this way, measures and strategies must be implemented to reap the benefits associated with carbon reporting. This positive relationship suggests that quality management can establish policies and strategies that can turn the negative effect of carbon accounting on the firms' performance into a positive impact. Secondly, for the banks to fully benefit from carbon accounting, they must also have quality management to balance spending resources on carbon issues and reaping the benefits from such activities. These results demonstrate that quality management is a prerequisite for carbon accounting because they would have the skills and the knowledge to gauge the kind of carbon information their stakeholders need. These results are not surprising because Bai and Chang (2015), Ali et al. (2019), and Solikhah et al. (2021) confirm that quality management positively influences the relationship between carbon accounting and firms' performance.

The results further demonstrate that audit quality has a positive and insignificant relationship with ROCE and NIM in all the models except for model 2. These results suggest that firms do not gain significant financial benefits from the Big4 audit firms. However, as demonstrated in model 2, firms obtain substantial financial benefits from the services of the Big4 auditing firms. The results further show that the size of an economy (EcoSize) has a positive but insignificant ( $p > 0.05$ ) relationship with ROCE and NIM in models 1, 2, 3, and 4, indicating the banks in East Africa do not benefit from the economic might of the countries they operate. This result is inconsistent with the expectation as well as the widespread view that firms' performance is influenced by the size of an economy, which is an indicator of economic activity.

As indicated by the results of models 1 to 4 and consistent with the expectation, firm size (FSize) had a positive and significant relationship with ROCE at 0.05. Furthermore, the relationship between FSize and NIM is also positive and significant at 0.05 in model 3 and 0.01 in model 4. These results suggest that banks with significant assets generate more profits than those with fewer assets. This is reasonable because the majority of the assets of banks are in the form of cash, usually given out as loans. Therefore, a bank that provides more loans would get more interest, which would translate to improved performance. This result is in harmony with Saka and Oshika (2014), who found that firm size has a positive relationship with firms' performance.

Similarly, firm age (FAge) had a positive relationship with ROCE in models 1 and 2, with the relationship being significant at 0.05 in model 2. In addition, model 3 shows a positive and significant ( $p < 0.05$ ) relationship between FAge and NIM, while the relationship between NIM and FAge is insignificant in model 4. The robustness tests show that the models have high predictive power, demonstrated by the  $R^2$  of more than 0.85. The result suggests that the independent variables in the models could predict the dependent variables up to not less than 85%. The F-statistics and the probability of the F-statistics ( $p < 0.000$ ) results further emphasize the high predictive power of the models.

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## CONCLUSION

The study examined the impact of carbon accounting on the financial performance of banks in East Africa and how management quality moderated the relationship. Seventy-nine banks from four East African countries were covered in the study. The study relied on eight years of annual, integrated, sustainability and reports for the carbon accounting data, which was measured based on a dichotomous response. A random effect estimation technique was employed to estimate the models. The major highlight of the findings was that carbon accounting had a negative relationship with the financial performance of firms. The result showed that carbon accounting had a negative but insignificant impact on the return on capital employed, implying that the banks that disclose carbon information did not benefit through increased ROCE. The study further found an inverse and insignificant relationship between carbon accounting and net interest margin, suggesting that carbon accounting negatively affected NIM of banks. These results suggest that the disclosure of voluntary carbon information did not reflect in the financial performance of firms. Finally, the study provided evidence to confirm that firms with quality management benefited from improved ROCE and NIM due to carbon accounting. The result demonstrated that quality management resulted in a higher ROCE and NIM among the banks that adopted carbon accounting practices.

In conclusion, carbon accounting was not beneficial to banks in East Africa. However, banks that had quality management financially benefited from carbon accounting. The significant implication of these results is that banks can benefit from adopting carbon accounting, but only when they have quality management. Further studies can be conducted to establish whether the impact of carbon accounting on firm performance is more pronounced in the short or long term.

## AUTHOR CONTRIBUTIONS

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