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Carbon Management Accounting and Performance Of Quoted Consumer Goods Manufacturing Firms In Nigeria

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ABSTRACT: This study intends to examine the effect of carbon management accounting and performance of quoted consumer manufacturing firms in Nigeria. Due to a series of extreme weather events that have occurred in recent years, climate change has been a subject that generates global risks and uncertainties. Therefore the current study specifically intends to evaluate the effect of effect of Greenhouse Gas Emissions (GHG) disclosure on Tobin's Q, and returns on asset (ROA). This study adopted the ex-post facto research design. The population of the study include all manufacturing firms quoted on the Nigerian Stock Exchange (NSE) as at 31st December 2020. The study relied on secondary sources of data which obtained from the sampled companies. The regression analysis was employed in validating the hypotheses. The findings revealed that Greenhouse Gas Emissions (GHG) disclosure has a significant effect on Tobin's Q of manufacturing firms. Also that Greenhouse Gas Emissions (GHG) Disclosure has no significant effect on return on assets (ROA) of manufacturing firms. The study recommended that manufacturing firms should make sustainability reporting a crucial aspect of the annual financial statements. In this regard, a qualitative or quantitative disclosure of carbon related information metrics is encouraged as a vital component of the sustainability report because of its long-term effect on the value of a firm;

Keywords: Carbon management accounting, Tobin's Q, and returns on asset.

I. INTRODUCTION

In the early 1990s, businesses neglected or ignored climate change issues (Haque & Deegan, 2010). Presently, regulatory and market-driven forces (Tang & Luo, 2014) are posing challenges to businesses to mitigate climate change from emissions (Weinhofer & Hoffmann, 2010). Stakeholders are seeking solutions in tackling climate change related issues across businesses, industry, and the society (Surminski, 2013; Linnenluecke & Griffiths, 2010).

The first international response to climate change was witnessed in 1992, when several countries joined the United Nations Framework Convention on Climate Change. The framework provided for international cooperation in combating climate change and coping with such impacts (Vanguard, 2018). Several years later, the Kyoto Protocol under which more than 150 countries agreed to strive to decrease carbon dioxide (CO_2) emissions was adopted (Ratnatunga & Balachandran, 2009). The Protocol's first commitment period started in 2008 and ended in 2012. The second commitment period began on 1 January 2013 and will end in 2020 (Vanguard, 2018).

On the corporate landscape, carbon accounting emerged to enable organisations provide strategic responses to climate change issues and move to lower-carbon business models (Alrazi, de Villiers, & van Staden, 2015). Concepts such as the carbon footprint model were developed to measure the impact (measured in CO_2-equivalent) that a product, service, or organisation has on climate change (Boguski, 2010). Carbon accounting provides a framework for measuring and disclosing carbon costs while enabling firms identify climate related risks and opportunities (Alrazi, de Villiers, & van Staden, 2016; Martinov-Bennie, 2012; Milne & Grubnic, 2011). Thus, carbon accounting provides a strategic response to GHG emissions adaptation (Linnenluecke, Birt, & Griffiths, 2015); by incorporating assets and liabilities associated with GHG emissions into traditional accounting systems (Hartmann, Perego, & Young, 2013).

Carbon reporting has also evolved from the broader environmental accounting spectrum

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(Stechemesser & Guenther, 2012) as a strategic response for greater transparency by investors (PriceWaterhouseCoopers, 2012). Both areas are all encompassing and touch almost all aspects of human life and values (Hoffman, 2011a, 2011b); thus, requiring that organisations, individuals, and societies change their production procedure, consumption patterns and life style (Levy & Egan, 2003; Giddens, 2009). It has been estimated that a significant and rapid reduction of total CO_2 emissions will be required if the growing environmental, social, and economic threats associated with climate change is to be halted (Cadez & Guilding, 2017). Although emission levels in sub-Saharan Africa (SSA) constitute the lowest in the world, the current per capita emission levels ranges between 2.7 billion and 3.9 billion tonnes of CO_2 when land-use change and forestry are respectively excluded and is higher than the stipulated 2.1 and 2.6 billion tonnes (Nartey, 2017).

Organizational performance has formed the crux of management literature for several decades. According to Volberda, Van Der Weerdt, Verwall, Stienstra, and Verdu (2012) superior organizational performance can only be achieved from a fit between organizational structure and the external environment in which a company operates. Therefore organizations should consider climate change and strategies related to climate change in order to leverage competitive advantage and superior market performance (Lee, 2012a; Kolk & Pinkse, 2004). Thus, the study investigates the effect of carbon management accounting and performance of quoted consumer goods manufacturing firms in Nigeria.

The study explores the link between carbon related information disclosure and a disaggregated view of accounting (Returns on asset and Returns on equity) and market performance measures. According to Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Alvarez, and García-Sánchez (2009), "ROA reflects a more technical character, more related to efficiency, whereas ROE provides a more financial view, that of stockholders (reflecting the demands expected by stockholders)". The study considers two dimensions of firm financial performance, accounting returns and market performance.

Moreover, in the issue of methodological approach to be adopted, Busch and Hoffmann (2011) stated that the relationship between Corporate Social Performance and Corporate Financial Performance has been widely analyzed using three methodological approaches, namely: event studies, portfolio analyses, and econometric approaches. The practicality of the first two approaches is limited in developing countries partly due to the nature of information disclosure which is usually ad-hoc for non-mandatory information. An advantage of econometric approaches is that they usually use accounting-based measures; which avails them the possibility to investigate causal relationships (Busch & Hoffmann, 2011).

The study is therefore set out to tackle the issues raised above in order to explore the effect of carbon management accounting on organisational performance in manufacturing firms.

The main objective of the study is to ascertain the effect of carbon management accounting and performance of quoted consumer goods manufacturing firms in Nigeria. The specific objectives of the study are to:

1. Examine the effect of Greenhouse Gas Emissions (GHG) disclosure on Tobin's Q of manufacturing firms.
2. Investigate the effect of Greenhouse Gas Emissions (GHG) disclosure on Return on Assets (ROA) of manufacturing firms.

II. REVIEW OF RELATED LITERATURE

2.1 Carbon Management System (CMS)

According to Tang and Luo (2014) CMS is "a way to implement a firm's carbon strategy or policy to enhance the efficiency of input-use, mitigate emissions and risks and avoid compliance costs or to gain a competitive advantage". CMS enables a company to identify its carbon emissions sources, measure its emissions inventory, and explore alternative options to cut its emissions levels (Wahyuni & Ratnatunga, 2014). According to Yunus, Elijido-Ten, and Abhayawansa (2014) CMS relates to a pattern of activities that mitigate a firm's direct and indirect greenhouse gas (GHG) emissions. Lee (2011) defines a corporate carbon strategy as "a firm's selection of the scope and level of its carbon management activity in response to climate change"; where, "scope" refers to what activities are being fulfilled and "level" refers to the extent to which the activities are integrated into the general strategic activities and operations of the company. The exact composition of a carbon management strategy is:

"Company-specific, depending on the (perceived) risks and opportunities related to climate change and the type of regulation relevant for the industry and countries in which companies operate" (Kolk & Pinkse, 2005).

Prior literature classified carbon management strategies in a continuum or typologies (Lee, 2011; Jeswani, Wehrmeyer, & Mulugetta, 2008; Kolk & Pinkse, 2005). The study

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by Jeswani, Wehrmeyer, and Mulugetta (2008) on the response of British and Pakistani businesses to climate change identified four major clusters based on climate change strategies: indifferent, beginners, emerging and active. Indifferent firms do not have emissions assessment or monitoring, while beginners have some operational activities but commit few resources to energy efficiency projects.

Emerging firms have set up emissions monitoring, assessment, inventory and targets but their actions are limited to meeting regulatory requirements. Active firms, in contrast, have a fully developed emissions management system and undertake a wide range of operational and strategic activities to mitigate carbon emissions. Kolk and Pinkse (2005) classify the strategic options facing businesses as a matrix in two dimensions: strategic intent (innovation or compensation) and the form of the organization (degree of interaction: internal, vertical, or horizontal). Weinhofer and Hoffmann (2010) presented a model incorporating a temporal perspective to categorize three types of strategies: carbon compensation, carbon reduction, and carbon independence. Hoffman (2006) delineates five steps for implementing these strategies: assess carbon exposure, compare exposure with the competitions, assess mitigation options, assess strategies to gain competitive advantage, and develop a strategic plan. The table below gives a description of the elements of a Carbon Management System (CMS). The table 2.4 identifies 10 basic elements within 4 perspectives in a theoretical CMS.

2. 2 Carbon Reporting

According to Najah (2012) carbon reporting is a "set of quantitative and qualitative information that relates to a firm's past and forecasted carbon emissions levels; its exposure to and financial implications of climate change associated risk and opportunities; and its past and future actions to manage these risks and opportunities". Carbon reporting provides an important mechanism to exert pressure on firms to reduce their emissions; and, thus could have a role in achieving climate mitigation objectives (Ennis, Kottwitz, Lin, & Markusson, 2012).

The disclosure of carbon-related performance has increased significantly over the last five years; however, they still remain of a voluntary nature (Andrew & Cortese, 2011). Numerous studies have examined the impact of global warming, carbon market and carbon regulations on corporate accounting practices (IETA 2007; Bebbington & Larrinage-Gonzalez, 2008; Cook, 2009; Hartmann, Perego, & Young, 2013).

The main concern for both researchers and practitioners has been the measurement of carbon performance, the development of carbon emission indexes, or GHG emissions reporting (Sullivan & Gouldson, 2012; Ascui & Lovell 2011, 2012; Freedman & Jaggi, 2005). In addition is the provision of information to support managerial decisions with sustainability implications (Stechemesser & Guenther 2012; Ascui & Lovell, 2012; Scipioni, Manzardo, Mazzi, & Mastrobuono, 2012).

2.3 Organisational Performance

In measuring organizational performance, managers use financial and non-financial metrics to assess the ability and that of the whole organization in moving the business towards financial performance (Al Shahrani & Zhengge, 2016). They further developed a conceptual model which depicted the relationship between selected firm characteristics and organisational performance proxied as ROA for service firms.

Financial performance is a measure of how well a firm can use capital or assets from its primary mode of business and generate revenues (Investopedia, 2018). In broader sense, financial performance refers to the degree to which financial objectives being or has been accomplished. It is the process of measuring the results of a firm's policies and operations in monetary terms. It is used to measure firm's overall financial health over a given period of time and can also be used to compare similar firms across the same industry or to compare industries or sectors in aggregation. According to Yee, Yeung and Cheng (2008), there are several indicators useful for evaluating financial performance of an organization, namely: revenue, asset and profit.

The drawbacks of sole reliance on financial performance measures to monitor performance (Kaplan Financial, 2012):

1. **Short-termism**: Linking rewards to financial performance may tempt managers to make decisions that will improve short-term financial performance but may have a negative impact on long-term profitability.
2. **Internal focus**: Financial performance measures tend to have an internal focus. In order to compete successfully it is important that external factors (such as customer satisfaction and competitors' actions) are also considered.
3. **Manipulation of results:** In order to achieve target financial performance (and hence their

reward), managers may be tempted to manipulate results.

Studies have been conducted on determinants of financial performance. They include, Dasuki (2016) in Turkey reported that long-term debt and total debt have significant negative effect on financial performance measured by ROA. Mirza and Javed (2013) in Pakistan showed that debt to equity ratio has a positive impact on performance, while long-term debt to total assets and short-term debt to total assets have a negative impact on firm performance. Onaolapo and Kajola (2010) in Nigeria found that capital structure surrogated by Debt Ratio had a significant negative impact on firm's financial measures proxied as Return on Asset and Return on Equity.

Non-Financial performance measures measure the non-financial aspects of the firm. Examples of non-financial performance measures are measures such as workforce development, product quality, customer satisfaction, on time delivery, innovation measures, attainment of strategic objectives, market share, efficiency, productivity, leadership and employee satisfaction (Ibrahim & Lloyd, 2011; Datar, Kulp, & Lambert, 2001). Non-financial performance measures have several important benefits compared to financial performance measures. First, high performance on non-financial performance measures is positively related with future financial performance. In this way, non-financial performance measures can instigate the CEO to take actions that benefit the firm in the long term (Banker, Potter, & Srinivasan, 2000). Second, non-financial performance measures reduce the amount of earnings management (Ibrahim & Lloyd, 2011). One important limitation of non-financial performance measures is that they may be biased, that their computation may change over time and often differs between firms, which hamper comparison of performance between firms (Eccles & Mavrinac, 1995). Ittner, Larcker, and Rajan (1997) also argue that these non-financial performance measures are easier to manipulate than the financial measures since they are rarely subjected to public verification.

2.4 Empirical Review

This section reviews studies on carbon management accounting practices and organisational performance, globally and nationally. They are briefly summarised below as follows: Ganda and Milondzo (2018) examined the impact of carbon emissions on corporate financial performance in South Africa. The sample comprised 63 South African CDP companies for the 2015 fiscal year. The study used multiple regression technique to analyze the data. The results showed a negative significant relationship between ROE and ROI with carbon emission intensity (scope 1), ROS was positive for clean industries [ROI and ROS was negative but non-significant; while ROE was positive for dirty industries]; positive non-significant relationship for ROE and ROI but negative for ROS with carbon emission intensity (scope 2) [ROE, ROI and ROS was negative but non-significant for dirty industries]; negative non-significant relationship for ROE, ROI and ROS with carbon emission intensity (scope 1&2) [ROE, ROI and ROS was negative but non-significant for dirty industries]. Mildawati, Agustia, and Soewarno (2018) examined the effect of climate change strategy on company's performance, and the mediating role of climate change disclosure in Indonesia. The sample comprised 266 firm years from the Indonesia Stock Exchange over the period 2010 to 2016. The study relied on secondary data obtained from annual reports, sustainability reports, and corporate website. The results showed that both a proactive and reactive climate change strategy have a positive influence on company's performance (ROA, ROE, and Tobin's Q), secondly, climate change strategy has a positive influence on climate change disclosure, and, thirdly, climate change disclosure has a positive influence on company's performance. Lastly, climate change disclosure mediated the influence of climate change strategy on company's performance. Udeh and Ezejiofor (2018) ascertained the effect of sustainability cost accounting on financial performance of Nigerian telecommunication firms. The study employed Ex post fact research design.. Formulated hypotheses were tested using regression analysis with the aid of SPSS Version 20.0. Based on this, the study found that Sustainability cost accounting has significantly affected return on assets of Nigerian telecommunication firms. Another finding is that sustainability cost accounting has significantly affected return on equity of Nigerian telecommunication firms.

Egbunike and Emudainohwo (2017) examined the role of carbon accountant in corporate management systems in Nigeria. The study adopted the descriptive survey and ex-post facto research design. The study relied on both primary and secondary sources. Primary data was obtained from questionnaires administered to accountants; while, the secondary data was obtained from annual reports. The hypotheses were tested using t-test and OLS regression. The results showed that carbon related disclosure had negative and significant effect on ROE; while, the other

hypothesis confirmed that accountants play a role in setting up a corporate carbon management system. Rokhmawati, Gunardi, and Rossi (2017) examined the effect of greenhouse gas (GHG) emissions on return on sales (ROS) that is moderated by customers' response to firm activities to reduce GHG emissions in Indonesia. The final sample comprised 102 listed manufacturing firms for 2010 and 2011. The study used moderating regression with cross-sectional data to analyze the data. The results showed that CO_2e intensity had a positive significant effect on ROS. Customers' response to firm activities to reduce GHG emissions had a positive and significant effect on ROS. Finally, customers' responses strengthen the effect of CO_2e intensity on ROS.

Liu, Zhou, Yang, and Hoepner (2016) examined the relationship between corporate carbon emission and financial performance in the U.K. The sample comprised 62 FTSE 100 companies from 2010 to 2012. They employ secondary data from annual reports and stand-alone CSR reports. The data was analysed using mediation path analysis via Structural Equation Modelling. The results showed that carbon emission is negatively associated with financial performance; however, it is positively related to the level of carbon disclosures (companies with more carbon emissions make more extensive disclosures) which is significantly and positively related to financial performance (more carbon disclosures lead to higher subsequent share return for the company). Gatimbu and Wabwire (2016) examined the effect of corporate environmental disclosure on financial performance of firms in Kenya. The study used the casual research design to determine the cause-effect relationship between corporate environmental disclosure and financial performance. The sample comprised 32 listed companies on the Nairobi Stock Exchange. The data was analyzed using content analysis and linear regression model. The results showed that firm size and leverage had a positive but non-significant effect on environmental disclosure. Also, that there was a significant difference in the mean financial performance of firms with high or low environmental disclosure ratings. Iskandar and Fran (2016) investigated the influence of carbon emission disclosure and corporate social responsibility on firm value in Indonesia. The sample comprised 12 manufacturing firms listed in Indonesia Stock Exchange from 2010 to 2013. The study relied on secondary data obtained from annual reports and corporate sustainability reports. The hypothesis was analyzed using multiple regression technique. The results of the study showed that carbon emissions disclosure correlated negatively and significantly with value of the firm; while, corporate social responsibility disclosure correlated positively and significantly with value of the firm. Luo and Tang (2016) used the holistic approach used by Tang and Luo (2014) and data from large companies that participated in the Carbon Disclosure Project to measure the quality of carbon management systems. There results show that the overall quality of carbon management systems improved in 2012 relative to 2011, and the quality of carbon management systems is associated with the presence of an emission trading scheme, competitor pressure, the nature of the legal system, and carbon exposure. In addition, country-level and firm-level factors impact the types of carbon management systems adopted by the firms in our sample.

Ezejiofor, John-Akamelu and Chigbo Ben (2016**)** determined the effect of sustainability accounting measure on the performance of corporate organizations in Nigeria. Ex post facto research design and time series data were adopted. Data for study was collected from annual reports and accounts of the company in Nigeria. Regression Analysis was used to test the formulated hypotheses with aid of SPSS Version 20.0. Based on the analysis, the study found that environmental cost does not impact positively on revenue of corporate organizations in Nigeria, also that environmental cost impact positively on profit generation of corporate organizations in Nigeria. Yunus, Elijido-Ten, and Abhayawansa (2014) investigated the relationship between firm's carbon management strategy adoptions, financial performance and carbon performance in Australia. The study was based on secondary data. They employed content analysis to study carbon management strategies. The data was analyzed using multiple regression technique. The analysis results showed that adopt CMS adoption is associated with superior financial performance. However, they found no significant relationship between CMS adoption and a firm's carbon performance. Thirdly, the study also reports a positive significant relationship between financial performance and carbon performance of firms. Saka and Oshika (2014) examine the association between corporate carbon emission and firm value in the Japanese context. Instead of using the voluntarily reported volume of carbon emissions, they use mandatorily reported carbon emissions data, which is claimed to solve the endogeneity problems in previous studies. Consistent with previous studies, they use market value of equity to measure corporate value. They find evidence that

carbon emissions and firm value are negatively related. Tang and Luo (2014) proposed a carbon management system (CMS) comprising of 10 essential elements from four broad perspectives: carbon governance, carbon operation, emission tracking and reporting, and engagement and disclosure. They used Carbon Disclosure Project reports to examine empirically the implementation of systems by large Australian firms. They find that firms with higher quality CMS have achieved better carbon mitigation. They also find that adequate assessment of carbon risk and opportunity, the presence of reduction targets, the strength of carbon programs and enhanced external disclosures appear to be the most effective elements in the sampled firms. Hassan and Kouhy (2014) examined environmental disclosure–performance link of the Nigerian Oil and Gas industry. First, they examine the relationship between gas flaring related environmental performance and its volumetric disclosure with a view to providing empirical evidence about vulnerability. Secondly, the relation between gas flaring related environmental performance and its disclosure substance to provide empirical support for exploitability. Eleven oil and gas companies served as population and sample for the study. Content analysis was used to measure the substance and volume of disclosure. The data envelopment analysis model, which is based on the mathematical technique of linear programming, is used for measuring carbon emission performance. The results document a significant negative association between the substance of disclosure and performance.

Okoye and Ezejiofor (2013) assessed the appraisal of Sustainability environmental accounting in enhancing corporate performance and economic growth. This study reviewed various forms including journal papers, articles and other relevant materials. This paper analyzed and tested two hypotheses with Pearson Product Movement Correlation Co-efficient. Based on this, the study discovered that sustainable environmental accounting has significant impact on corporate productivity in order to enhance corporate growth.

Luo, Lan, and Tang (2012) investigated how the Global 500 companies respond to the challenge of climate change with regard to their carbon disclosure strategies. They considered the impact of social, financial market, economic, regulatory, and institutional factors on the motivation to voluntarily participate in the 2009 Carbon Disclosure Project. They find that economic pressure is significantly associated with the decision. Companies in greenhouse gas (GHG) intensive sectors show the same tendency. In addition, big companies have a higher propensity for disclosing, suggesting that social pressure plays an important role. In sum, it appears that the major driving force for climate change disclosure comes from the general public and government rather than from the other major stakeholders such as shareholders and debt holders. Ennis, Kottwitz, Lin, and Markusson (2012) explored the relationship between carbon disclosure and performance among FTSE 350 companies. They used the Carbon Disclosure Leaders Index (CDLI) to calculate disclosure scores. Two carbon performance measures were used in this study. First was the absolute level of emission, which is the total of scope 1 and scope 2 emissions reported in CDP. Second was the emission intensity measure (or index measure) that is calculated as the reported emission (direct and indirect) per unit of company revenue. Carbon emissions data was obtained from the CDP, selecting FTSE 350 companies that have reported consistently over the period from 2006 to 2009 using the GHG protocol. The results showed that there was no significant relationship between voluntary carbon disclosure and emissions performance. Thus, emissions levels are not presently considered drivers of stock prices.

Efforts in incorporating carbon accounting into traditional decision and reporting processes has had not done much in reducing the lack of research focusing on carbon accounting (Hartmann, Perego, & Young, 2013), (Delmas, Nairn-Birch, & Lim, 2015; Hopwood, 2009; Lohmann, 2009; Kolk, Levy, & Pinkse, 2008). The study identified four from the review of related literatures. Firstly, few studies have used accounting and market based measures to systematically test the hypothesis between GHG emissions disclosure and financial performance.

In addressing theme methodological approach adopted in prior studies, the relationship between Corporate Social Performance and Corporate Financial Performance has been widely analyzed using three methodological approaches, namely: event studies, portfolio analyses, and econometric approaches (Busch & Hoffmann, 2011). The practicality of the first two approaches is limited in developing countries partly due to the nature of information disclosure which is usually ad-hoc for non-mandatory information.

The study therefore intends to fill the gaps identified while exploring the effect of carbon management accounting on organisational performance in manufacturing firms.

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III. METHODOLOGY

3.1 Research Design

The study adopted the ex-post facto research design. The design is chosen because the researcher is interested in establishing the causal relationship among the dependent and independent variables, whose observation has already occurred. The ex-post facto design (after-the-fact) is a category of research design in which the investigation starts after the fact has occurred without interference from the researcher (Salkind, 2010). Within the ambit of the ex-post facto research design, the researcher adopted a cross-sectional and time series analysis of the financial report of the manufacturing companies quoted on the 1st tier security market of the Nigerian Stock Exchange.

3.2 Population of the Study

The population of the study comprises manufacturing firms listed on the Nigerian Stock Exchange (NSE) as at 31st December, 2020. The firms are classified under eleven (11) sectors, the details are shown in the table 3.2.

Table 3.1: Population of the study

S/No	Sector	No. of Firms
1.	Agriculture	5
2.	Conglomerates	6
3.	Consumer Goods	21
4.	Construction/ Real Estate	9
5.	Financial Services	47
6.	Health Care	10
7.	ICT	7
8.	Industrial Goods	14
9.	Natural Resources	4
10.	Oil & Gas	12
11.	Services	25
Total		**160**

Source: Nigerian Stock Exchange Website (2020)

3.3 Sample Size of the Study

The sample for the study was drawn from quoted consumer goods manufacturing firms on the Nigerian Stock Exchange. The study used the purposive sampling technique to ensure that the firms have homogenous properties. The companies included in the sample are shown in the table below:

Table 3.2: Companies included in the sample for the study

1.	DN Tyre & Rubber Plc.
2.	Champion Breweries Plc
3.	Golden Guinea Breweries Plc.
4.	International Breweries Plc.
5.	Nigerian Breweries Plc.
6.	7-up Bottling Company Plc.
7.	Dangote Flour Mills Plc.
8.	Dangote Sugar Refinery Plc.
9.	Flour Mills Nigeria Plc.
10.	Honeywell Flour Mill Plc.
11.	Guiness Nigeria Plc.
12.	N. Nigeria Flour Mills Plc.
13.	Union Dicon Salt Plc.
14.	Cadbury Nigeria Plc.
15.	Nestle Nigeria Plc.
16.	Nigerian Enamelware Plc.
17.	Vitafoam Nigeria Plc.

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18.	P.Z. Cussons Nigeria Plc.
19.	Unilever Nigeria Plc.
20.	Mcnichols Plc
21.	Nascon Allied Industries Plc.

Source: Nigerian Stock Exchange Website (2020)

3.4 Methods of Data Analysis

The data were extracted from the financial statements of the selected companies. Environmental issues can be found in annual reports, special environmental reports and/or company websites (Freedman & Jaggi, 2005).

The study employs several techniques to analyse the data. First, descriptive statistics were computed such as the mean, median, standard deviation, minimum, maximum values, and Skewness-Kurtosis statistics, etc. Secondly, regression was used to validate the hypotheses.

Decision Rule

The decision rule is based on the sign and significance of the computed t-statistic from the regression output. If the p value of the t statistic < .05 (the chosen alpha level) the null hypothesis is rejected; and, the variable is postulated to have a significant effect.

Model Specification

$Tobin's\ Q_{(i,t)} = \alpha + GHGDI_{(i,t)} + Firm\ Size + Leverage + SaGr + \mu$ ……1

$ROA_{(i,t)} = \alpha + GHGDI_{(i,t)} + Firm\ Size + Leverage + SaGr + \mu$ ……2

3.5 Variable Measurements

3.5.1 Carbon disclosure (Independent variables)

1. **Greenhouse Gas Disclosure Index** [CDI]: The GHGDI is constructed using content analysis methodology, a widely accepted procedure to enable reliability and valid inference from narrative data in compliance with their context (Krippendorff, 2013). Content analysis is a method of codifying the text (or content) of a piece of writing into various groups or categories depending on the selected criteria. Following coding, quantitative scales are derived to permit further analysis (Krippendorff, 2013; Michelon & Parbonetti, 2012). Smith (2003) describes content analysis as a technique employed to derive meaningful inferences from texts in a document based on a predetermined set of criteria. Content analysis is widely used and a very useful method of measuring environmental disclosure (Beck, Campbell, & Shrives, 2010; Campbell, 2000). Prior studies have measured the quantity of carbon information using sentences as a unit of analysis (Rahman, Rasid, & Basiruddin, 2014; Milne & Adler, 1999; Hackston & Milne, 1996; Ingram & Frazier, 1980). The study employs a qualitative content analysis to assess the quality of corporate carbon disclosure rather than the quantity of disclosure (Chelli, Durocher, & Richard, 2014; Cormier, Magnan, & Van Velthoven, 2005; Wiseman, 1982).

3.7.2 Organizational Performance (Dependent variables)

1. Return on Assets (ROA):- ROA is a standard accounting based measure of financial performance, calculated by dividing earnings before interest by total assets (King & Lenox, 2002). It demonstrates how efficiently a firm generates profit per unit of production.
2. Tobin's Q: This is a standard market based measure of financial performance. It is defined as the ratio of a firm's market value to the replacement cost of its assets. The Tobin's q can be calculated by dividing the sum of firm equity value, book value of long-term debt, and net current liabilities by total assets (Chung & Pruitt, 1994; King & Lenox, 2002).The Tobin's q reflects intangible measures of performance, like investor confidence and reputation.

Control Variables:

The control variables of the study are: firm size, leverage, dividend payouts, and sales growth.

1. Firm size is proxied using the logarithm of total assets of the firm as at end of financial year. Prior studies have documented a positive relation between size and the volume of information voluntarily disclosed (Marston & Polei, 2004; Bonsón & Escobar, 2004; Gul & Leung, 2004; Prencipe, 2004). Large firms may exhibit more socially responsible behavior than smaller firms (Waddock & Graves, 1997) as their reputation and legitimacy is influenced by media attention (Bansal & Clelland, 2004).
2. Leverage is measured as the ratio of total debt to total assets. In this sense, "companies with more debt have greater agency costs, because there is a possibility of transference of wealth

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from debt holders to stockholders. By increasing the amount of information disclosed, corporations can reduce their agency costs and any possible conflicts of interest between owners and creditors" (Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Alvarez, & García-Sánchez, 2009, p. 1138). Several studies have found a positive effect of leverage on the amount of information revealed voluntarily (Xiao, Yang, & Chow, 2004; Prencipe, 2004; Jaggi & Lee, 2002), whereas others, do not find a statistically significant relationship (Gul & Leung, 2004; Oyelere, Laswad, & Fisher, 2003).

3. Sales growth is defined as the annual change in sales divided by total sales and controls for variations in production (King & Lenox, 2002). Sales growth = ((Current year's revenue/Last year's revenue) – 1) x 100%. It measures the changes in firms' revenues. Increases in revenues usually signal firms' opportunities for growth (Chen, Cheng, & Hwang, 2005).

IV. DATA PRESENTATION AND ANALYSIS

4.1Descriptive Statistics

This section outlines details of the descriptive statistics computed for the variables utilised in the study. Each variable is examined based on the mean, median, minimum, maximum, standard deviation, normality, etc. The descriptive statistics of the dependent variables of the study are shown in the table below:

Table 4.1: Summary Statistics (dependent variables)

	Tobin's Q	ROA
Mean	3.772601	0.068089
Median	0.599001	0.038547
Maximum	240.2884	1.973652
Minimum	0.017883	-3.021770
Std. Dev.	19.37295	0.389126
Skewness	11.05393	-0.709842
Kurtosis	134.0766	34.50992
Jarque-Bera	123688.8	6964.234
Probability	0.000000	0.000000
Sum	633.7970	11.43903
Sum Sq. Dev.	62676.96	25.28699
Observations	168	168

Source: E-Views 9

The mean of Tobin's Q within the time frame of the study was 3.773, i.e., the ratio of the market value of a company to its replace cost indicated that firms in the sample had market values 3 times more than the replacement cost of assets; the average ROA of the studied firms was 0.068, this proxy often calculated as the ratio of earnings before interest, tax, and depreciation to total asset is an indication that earnings for the firms were approximately 6 percent of the assets in the sampled firms. The p-values of the Jarque-Bera statistics were all less than .05; indicating the non-normality of the dependent variables utilised in the study.

The descriptive statistics of the independent and control variables utilised in the study are shown in the table below:

Table 4.2: Summary Statistics (independent and control variables)

	GHGDI	Average Asset	Sales Growth	Leverage
Mean	0.071925	1.27E+11	3.917386	0.410464
Median	0.062500	6.59E+10	0.063997	0.106977
Maximum	0.140625	6.87E+11	293.2908	12.95956
Minimum	0.000000	1.04E+08	-1.000000	0.000000
Std. Dev.	0.053419	1.57E+11	27.15660	1.409647
Skewness	0.253924	1.618162	9.235539	6.978775
Kurtosis	1.443569	4.838224	91.20058	55.79872
Jarque-Bera	18.76272	96.97000	56843.66	20877.62
Probability	0.000084	0.000000	0.000000	0.000000

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Sum	12.08333	2.13E+13	658.1209	68.95800
Sum Sq. Dev.	0.476542	4.10E+24	123159.3	331.8463
Observations	168	168	168	168

Source: E-Views 9

The average GHGDI value was 0.0719; i.e., on the average a 7.19 percent of the items in the disclosure checklist were disclosed by the sampled firms. The proxy for firm size was average assets (computed as opening assets + closing assets/ 2) showed figures in the range of billions for the sampled firms; sales growth had mean value of 3.917, i.e., the sales of the sample firms increased at rate of 4 percent year-on-year change. The average value of leverage was 0.410, in other words, debt accounted for about 41 percent of equity in the sampled firms. The p-values of the Jarque-Bera statistics were all less than .05; indicating the non-normality of the independent and control variables utilised in the models.

4.3 Test of Hypotheses

The hypotheses were tested using Heteroskedasticity corrected OLS computed using the gretl software package. The empirical models included both the GHGDI as the main independent variable and the lag of GHGDI. This approach enables using the past period values of (i.e., GHGDI(-1)) to explain the variation in the dependent variable.

Hypothesis One

Ho_1: Greenhouse Gas Emissions (GHG) disclosure has no significant effect on Tobin's Q of manufacturing firms.

Table 4.4: Heteroskedasticity –corrected OLS output for hypothesis one

Dependent variable: Tobin's Q

	Coefficient	Std. Error	t-ratio	p-value	
Const	1.67226	0.548809	3.047	0.0028	***
GHGDI	100.593	16.8652	5.965	<0.0001	***
GHGDI(-1)	−107.646	16.7976	−6.408	<0.0001	***
Average Asset	−1.29447e-012	6.43614e-013	−2.011	0.0462	**
Leverage	0.875103	0.753881	1.161	0.2477	
Sales Growth	−0.00314817	0.00554672	−0.5676	0.5712	

Statistics based on the weighted data:

Sum squared resid	271.0382	S.E. of regression	1.386455
R-squared	0.993783	Adjusted R-squared	0.993562
F(5, 141)	4507.533	P-value(F)	1.3e-153
Log-likelihood	−253.5533	Akaike criterion	519.1065
Schwarz criterion	537.0491	Hannan-Quinn	526.3968

Statistics based on the original data:

Mean dependent var	4.147344	S.D. dependent var	20.67653
Sum squared resid	59963.79	S.E. of regression	20.62220

Source: gretl (GNU Regression, Econometric and Time Series Library) ver. 2021

The results shown in the Table above, shows that the R-squared (R^2) (a statistical measure that represents the proportion of variance in the dependent variable due to changes in the independent variables in a regression model) showed a value of 0.9937; i.e., 99.4% variation was explained by the predictor variables. The Adjusted R-squared (i.e., R^2 adjusted for the number of predictors in the model) showed a value of 0.9935; i.e., the explanatory variables account for 99.4% variation in Tobin's Q. The F statistic (ratio of the mean regression sum of squares divided by the mean error sum of squares) checks the statistical significance of the model a value of 4507. 533 (p value <.05); therefore the hypothesis that all regression coefficients are zero is rejected. However to validate the hypothesis, the p-value of GHGDI from the model coefficients section is

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examined; the GHGDI showed a t statistics value of 5.965 (p=0.0001<.05); which, leads to the rejection of the null and acceptance of the alternate thus, Greenhouse Gas Emissions (GHG) disclosure has a significant effect on Tobin's Q of manufacturing firms.
The resulting regression equation is specified as follows below:

Tobin's Q = 1.67 + 101*GHGDI - 108*GHGDI(-1) - 1.29e-012*Average Asset + 0.875*Leverage - 0.00315*Sales Growth.

Hypothesis Two

Ho_2: Greenhouse Gas Emissions (GHG) Disclosure has no significant effect on return on assets (ROA) of manufacturing firms.

Table 4.5: Heteroskedasticity –corrected OLS output for hypothesis two

Dependent variable: ROA

	Coefficient	Std. Error	t-ratio	p-value	
Const	0.0799346	0.0174546	4.580	<0.0001	***
GHGDI	0.544154	0.635398	0.8564	0.3932	
GHGDI(-1)	−0.707165	0.640354	−1.104	0.2713	
Average Asset	0.000000	0.000000	−0.7353	0.4634	
Leverage	−0.0194633	0.0274744	−0.7084	0.4799	
Sales Growth	0.000239361	0.000440149	0.5438	0.5874	

Statistics based on the weighted data:

Sum squared resid	1147.833	S.E. of regression	2.853184
R-squared	0.097133	Adjusted R-squared	0.065116
F(5, 141)	3.033822	P-value(F)	0.012424
Log-likelihood	−359.6410	Akaike criterion	731.2821
Schwarz criterion	749.2247	Hannan-Quinn	738.5723

Statistics based on the original data:

Mean dependent var	0.073375	S.D. dependent var	0.414228
Sum squared resid	25.32163	S.E. of regression	0.423776

Source: gretl (GNU Regression, Econometric and Time Series Library) ver. 2021

The results shown in the Table above, shows that the R-squared (R^2) (a statistical measure that represents the proportion of variance in the dependent variable due to changes in the independent variables in a regression model) showed a value of 0.097; i.e., 9.7% variation was explained by the predictor variables. The Adjusted R-squared (i.e., R^2 adjusted for the number of predictors in the model) showed a value of 0.065; i.e., the explanatory variables account for 6.5% variation in ROA. The F statistic (ratio of the mean regression sum of squares divided by the mean error sum of squares) checks the statistical significance of the model a value of 3.034 (p value <.05); therefore the hypothesis that all regression coefficients are zero is rejected. However, to validate the hypothesis, the p-value of GHGDI from the model coefficients section is examined; the GHGDI showed a t statistics value of 0.8564 (p=0.3932>.05); which, leads to the rejection of the alternate and acceptance of the null thus, Greenhouse Gas Emissions (GHG) Disclosure has no significant effect on return on assets (ROA) of manufacturing firms.
The resulting regression equation is specified as follows below:

ROA = 0.0799 + 0.544*GHGDI - 0.707*GHGDI(-1) - 4.31e-014*Average Asset - 0.0195*Leverage + 0.000239*Sales Growth

V. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study examines carbon management accounting and performance of quoted consumer goods manufacturing firms. Globally and across several corporate landscapes the issue of climate change has taken a centre stage in the discussion on how individuals, communities, organisations and national governments can contribute to tackling this undesirable change. The present study

investigates the effect of Greenhouse Gas Emissions (GHG) disclosure on Tobin's Q, and ROA of quoted consumer goods manufacturing firms. The results showed mixed findings. While, Greenhouse Gas Emissions (GHG) disclosure showed a significant positive effect on Tobin's Q; Greenhouse Gas Emissions (GHG) disclosure also showed a non-significant positive effect on ROA. Overall, the results confirm that Greenhouse Gas Emissions (GHG) disclosure is much more important to the long-term firm valuation of a company rather than short-term financial performance.

5.2 Recommendations

Based on these findings, the study makes the following recommendations:

1. Manufacturing firms should make sustainability reporting a crucial aspect of the annual financial statements. In this regard, a qualitative or quantitative disclosure of carbon related information metrics is encouraged as a vital component of the sustainability report because of its long-term effect on the value of a firm;
2. Managers should create and drive policy framework that focus on the triple bottom line; rather than a myopic focus on the financial bottom line. Despite the non-significant positive effect of GHG disclosure on ROA; there is a growing belief that this rather neglected area is gaining awareness in developing countries and soon consumers and shareholders may even boycott products or shares of non-green companies and ultimately lead to a decline in net income.

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