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ASSESSING THE IMPACT OF SOCIAL, ENVIRONMENTAL, AND SUSTAINABLE PROCUREMENT PRACTICES ON FINANCIAL AND OPERATIONAL EFFICIENCY IN DANGOTE CEMENT

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ABSTRACT

The cement sector makes a sizable contribution to global carbon emissions, sustainability practices in this sector are essential for preserving the environment. The largest cement manufacturer in Nigeria, Dangote Cement PLC, has made several sustainability commitments as part of its corporate strategy. However, there hasn't been enough research done on how these practices affect corporate success and environmental preservation in Lagos State, Nigeria. The goal of this study is to evaluate how well Dangote Cement PLC's sustainability initiatives are working in Lagos State, Nigeria. This study is important because it has the potential to guide corporate decisions and inform legislation regarding sustainable practices in the cement sector, particularly in developing nations. The research findings might also contribute to the body of knowledge on corporate social responsibility and sustainability in high-emission industries. An extensive investigation of Dangote Cement's sustainability practices, their effects on the environment, and how they affect the company's financial success are all part of the research's content. The study will also examine how business activities strike a balance between economic, environmental, and social sustainability.

Key words: Sustainability practice, Environmental, Dangote Cement. Financial Efficiency, Organizational performance

1 INTRODUCTION

Dangote Cement PLC, formerly known as the Obajana cement Plant, was founded in 1981 and has grown to be a significant player in Nigeria's landscape. It has grown over time, going from being a cement producer to becoming the biggest cement manufacturer in Africa (Akinyoade & Uche 2016) It is indisputable that the company dominates Nigeria's cement market (Charles, Orawari, Udom, Ozoemena, & Orawari, 2023) Part of Nigeria's cement needs is satisfied by Dangote Cement, which has a strategically positioned network of plants across the nation. Additionally, because it operates in African nations and is essential to the development of regional infrastructure, its influence transcends national borders. Dangote Cements' commitment to upholding strict quality standards and welcoming innovation is the secret to its success. By consistently investing in cutting-edge production techniques and machinery, the company can precisely deliver cement products that satisfy global standards (Akinyoade & Uche 2018). The cement market

dominance of Dangote Cement PLC in Nigeria can be attributed to its wide network of strategically positioned plants, which demonstrate a comprehensive approach towards meeting the rapidly increasing cement demands of the country. Because of this network's strong production capacity, the company can supply a significant amount of Nigeria's growing cement demand. Dangote Cement has deliberately extended its reach throughout the African continent, even beyond the boundaries of Nigeria. Its operations across multiple African nations demonstrate not only its regional clout but also its important role in promoting infrastructure development. This expansion is a sign of the company's dedication to taking center stage in regional markets and advancing these countries' economies as a whole. Dangote Cement's strategic expansion approach is not limited to gaining market share, it is also infused with a forward-thinking perspective that seeks to promote sustainable development throughout Africa. Using its activities, the company cultivates job prospects, enhances economic activity, and supports the construction industry, thereby establishing itself as a driving force behind advancement and prosperity in the areas in which it conducts business (Santoso, Purwoko, Umar, & Renwarin, 2020). This growth demonstrates Dangote Cement's dedication to establishing a strong basis for long-term growth and development throughout the African continent in addition to solidifying its market position

With an eye toward the future, Dangote Cement is still dedicated to setting high standards. Its vision includes continued growth, ongoing innovation in production methods, and unwavering commitment to sustainability. The company wants to become a leader in sustainable business practices and corporate responsibility, in addition to the cement industry. All things considered, Dangote Cement PLC is a monument to visionary leadership, top-notch operations, and an unwavering dedication to improving Nigeria's infrastructure and economy. Its journey is an amalgam of development, creativity, and a resolute incorporation of sustainability principles into its central business plans. A fundamental shift in priorities has been observed in the global business landscape in recent years, with a growing emphasis on sustainability. This change is a reflection of the understanding that corporate operations, environmental protection, and social welfare are all intertwined (Kabiraj, Topkar, & Walke 2010). Cement production is among the many industries that have been forced to review their methods in light of their social and environmental obligations Energy-intensive processes and high carbon emissions have historically made industries like cement manufacturing extremely problematic for the environment. For these industries, adopting sustainability becomes essential, requiring attention to be paid to lowering carbon footprints, maximizing energy use, enhancing waste control, and guaranteeing ethical raw material sourcing. Dangote Cement has made sustainability practices an integral part of its business operations in recent years. With programs aiming at lowering the company's carbon footprint, encouraging community development, and promoting ethical practices throughout its supply chain, environmental stewardship and social responsibility have become essential. Dangote Cement's economic influence extends well beyond its contributions to industry. Notably, its activities support local economic expansion, create jobs, and are essential in supporting infrastructure, all of which have a major positive impact on Nigeria's economic development(mojekwo, Idowu, Sode, 2013).

Nigeria struggles with social issues like poverty and restricted access to healthcare and education, in addition to environmental problems like deforestation, pollution, and poor waste management. By reducing environmental degradation, assisting communities, and promoting socioeconomic development, sustainable practices in sectors like cement manufacturing can have a big impact on these areas (Nawaz, Hussain, Noor, Habib, & Omair, 2020). Nigeria's steadfast dedication to sustainability aligns with international frameworks such as the United Nations Sustainable Development Goals (SDGs). These objectives offer a comprehensive road map for a sustainable future, addressing a wide range of topics like responsible production and consumption, sustainable cities, combating climate change, and the eradication of poverty. Businesses can address local issues and make a significant contribution to global initiatives by aligning with these goals. Sustainability efforts in Nigeria's cement industry cover a wide range of topics. These include initiatives to reduce greenhouse gas emissions, maximize the use of water and energy, encourage the ethical procurement and use of resources, participate in community development initiatives, and stimulate the development of cleaner production technologies. Adopting sustainability has real benefits for businesses that go beyond compliance. Stressing the inherent value of incorporating sustainability into business strategies, improves brand reputation, reduces operational risks, draws ethical investors, increases efficiency through resource optimization, encourages innovation, and maintains long-term profitability (Cici & D'Isanto, 2017).

Beyond industry boundaries, sustainability has become a critical business imperative. Aligning with global sustainability goals addresses local challenges and positions businesses as agents of positive change in the Nigerian cement sector. Embracing sustainability ensures long-term viability and success for businesses while also helping to create a more sustainable and prosperous future, in addition to benefits for the environment and society (Baglione, 2014). How Dangote Cement PLC manages its supply chain demonstrates its dedication to sustainable environmental practices, fair labor standards, and ethical sourcing. The company's strategy is multifaceted and designed to minimize environmental effects while adhering to strict ethical standards throughout the entire supply chain, from sourcing raw materials to distribution Dangote Cement's supply chain ethics are based on its defined guidelines and strict supplier vetting processes. By taking these steps, the business interacts with vendors who support its principles, placing a focus on openness, fair trade, and ethical sourcing methods (Asnake, Hirpha, & Ogato, 2019) Ensuring accountability throughout the supply chain, these ethical standards are regularly assessed and audited to confirm compliance. Dangote Cement prioritizes employee welfare and dignity when promoting fair labor practices. The company offers

opportunities for skill development, fair wages, and safe working conditions while adhering to international labor laws. The company's dedication to employee empowerment and promoting an inclusive and progressive work environment is demonstrated by its ongoing training programs and proactive engagement initiatives. An essential element of Dangote Cement's supply chain strategy is environmental stewardship. Sustainable practices are integrated by the company from quarrying to production and distribution. Reducing the environmental impact primarily requires investments in energy efficiency optimization, waste management techniques, and cleaner production technologies (Yong, Klemeš, Varbanov, & Huisingh, 2016). In addition, Dangote Cement actively pursues environmental conservation and reforestation projects in an effort to achieve a net positive impact on the ecosystems impacted by its operations.

Its supply chain ethos places a strong emphasis on cooperation and interaction with partners and stakeholders. Dangote Cement fosters partnerships based on openness, respect, and a common commitment to sustainability. A larger network of ethical practices within the supply chain ecosystem is influenced by partners who are encouraged to maintain comparable ethical and environmental standards (Ahmed, Ashraf, Khan, Kusi-Sarpong, Arhin, Kusi-Sarpong, & Najmi, 2020). The company's pursuit of sustainability is propelled by its dedication to innovation and ongoing improvement. In production, logistics, and transportation, utilizing technology, implementing best practices, and investigating sustainable alternatives are continual pursuits. The supply chain is kept in line with changing market demands and sustainability standards through ongoing assessment and adaptation. The business gives stakeholders thorough insights into its supply chain procedures and sustainability efforts through frequent reports. Asnake, Hirpha, and Ogato (2019) state that Dangote Cement cultivates trust and accountability among stakeholders by demonstrating its efforts to maintain ethical standards, support fair labor practices, and mitigate environmental impacts through transparent reporting mechanisms. The supply chain management of Dangote Cement PLC is essentially a comprehensive strategy that incorporates environmental responsibility, fair labor practices, and ethical sourcing. Through the maintenance of strict guidelines, encouraging team work, pushing for creativity, and guaranteeing openness, the business supports an ethical and sustainable supply chain. This strategy not only complies with international sustainability objectives, but it also demonstrates Dangote Cement's dedication to improving stakeholder and environmental outcomes. It is imperative to comprehend the significance and perception of sustainability practices within Dangote Cement PLC, considering the dynamic nature of environmental conservation and social welfare. Thus, the researcher attempted to evaluate the effects of sustainability practices in the Dangote Cement PLC in Nigeria based on this background.

2 LITERATURE REVIEW

Sustainability in the cement industry has become a pivotal focus due to its significant environmental impact. Cement production is energy-intensive and generates substantial carbon dioxide emissions, making it a prominent contributor to climate change. Hence, initiatives within the cement industry aim to address these challenges and transform the sector's practices towards sustainability.

2.1 Carbon Emissions Reduction

The industry is actively seeking methods to decrease carbon emissions by prioritizing cleaner technologies and enhancing energy efficiency in production processes. Multiple measures are being implemented, including the adoption of renewable energy sources, improving kiln efficiency, and integrating carbon capture and storage technologies. These measures have the objective of substantially reducing the carbon footprint of the sector and contributing to a more sustainable future. The cement industry is proactively involved in endeavors to decrease carbon emissions through the adoption of cleaner technologies, enhancement of energy efficiency in production processes, and exploration of alternative fuels (El-Salamony, Mahmoud, & Shehata, 2020). The adoption of renewable energy sources, the application of carbon capture and storage, and the improvement of kiln efficiency are vital in reducing the industry's carbon emissions. Considering the significant influence of the cement industry on climate change, it is imperative and urgent to decrease carbon emissions in this sector. The process of cement production is notorious for its substantial energy consumption and notable emissions of carbon dioxide (CO2). In response to this problem, the industry is adopting diverse strategies to minimize emissions. These strategies encompass the implementation of cleaner technologies, such as the utilization of advanced kiln designs and energy-efficient equipment. Furthermore, the reduction of CO2 emissions per unit of output can be achieved by implementing process optimization and incorporating heat recovery systems, which enhance energy efficiency (Benhelal & Zahedi, 2013). Implementing these measures is crucial for reducing the environmental consequences of cement manufacturing. Carbon capture and storage (CCS) technologies are being increasingly adopted in the cement industry. CCS, or carbon capture and storage, entails the capture of emissions during production and their secure underground storage, providing a substantial opportunity for reducing CO2 emissions. Furthermore, the industry is actively investigating alternative raw materials and pioneering cement compositions, such as supplementary cementitious materials (SCMs), to partially substitute clinker. This change can substantially reduce the amount of CO2 emissions linked to the production of clinker. Effective collaboration and knowledge sharing between cement companies are essential for expediting efforts to decrease emissions. By engaging in research collaboration, fostering innovation, and sharing best practices, the industry can make significant progress toward achieving a more sustainable future (Antunes, Santos, Pereira, Rocha, Horta, & Colaço, 2021). Joint ventures and collaborations in the

cement industry aim to facilitate the widespread implementation of sustainable technologies, by global climate change mitigation objectives.

The primary methods used to address carbon emissions in this industry involve the implementation of more environmentally friendly technologies, enhancing energy efficiency, investigating carbon capture and storage (CCS) alternatives, and integrating alternative materials (Mikulčič, Klemes, Vujanovic, Urbaniec, & Duic, 2016). The primary objective of these collaborative endeavors is to substantially diminish the carbon emissions generated by the cement industry, thereby conforming to worldwide environmental goals and guaranteeing the sustainable expansion of cement manufacturing.

3 MATERIALS AND METHODS

We utilized a time series analysis to establish a model that captures the relationship between the variables under study. Time series data is highly valuable for data analysis because of its distinct characteristics. Recording observations at regular intervals allows for the identification of trends, patterns, and correlations that develop over time. The resilience and suitability of time series data for analysis are apparent in various aspects. Firstly, it facilitates trend analysis, enabling us to determine whether a variable is experiencing growth, decline, or displaying other noticeable patterns. Furthermore, time series data is instrumental in identifying seasonal or cyclical fluctuations, revealing repetitive patterns that provide insights into underlying factors. Time series data excels in forecasting by utilizing historical patterns and relationships to predict future values or trends. Autocorrelation and lag analysis enhance its worth by facilitating the examination of connections and associations between present and previous observations. Statistical modeling techniques, such as ARIMA or exponential smoothing models, specifically designed for time series data, improve its ability to analyze data. Moreover, time series data enables the detection of anomalies by establishing a reference pattern and identifying deviations from it. The longitudinal nature of this approach enables the analysis of changes and shifts occurring within a subject or system over time, offering valuable insights into its growth and evolution. Visualizing time series data improves understanding by facilitating the recognition and communication of patterns and trends.

3.1 Source of data

We retrieved data from the website of Dangote Cement. The data spanned a period of 2012 to 2023. The data for the independent variable (sustainable practices) were based on social, environmental, and procumbent. Our dependent variable measured financial and operational efficiency.

Table 1: Variable source and data

variable	Abbreviation	Definition	Period	Source
Procurement	PRO	Sustain procurement	2012-2023	Dangote cement website
Social	SOC	CSR spending	2012-2023	Dangote cement website
Environment	ENV	co2 emissions	2012-2023	Dangote cement website
Financial	FIN	Revenue	2012-2023	Dangote cement website
Operational	OPE	Operation efficiency	2012-2023	Dangote cement website

3.2 Independent

The study employs sustainable procurement as a metric for sustainable practice, given its credibility and recognition as a sustainability indicator. Sustainable procurement is employed as a metric for evaluating sustainable practices due to its numerous advantages. Firstly, it quantifies the utilization of environmentally friendly products and services, thereby encouraging the adoption of sustainable materials, decreasing energy usage, and minimizing waste generation. Furthermore, it fosters the growth of sustainable industries and assists local businesses, thereby promoting economic expansion while simultaneously decreasing procurement expenses. Finally, incorporating sustainable procurement practices improves an organization's reputation by showcasing its dedication to sustainability and can result in beneficial effects on the environment, society, and the economy. Considering these factors, the utilization of sustainable practices offers an effective means of assessing sustainable practices at Dangote Cement.

3.3 Social

Building upon prior research, this study integrates the advantages of social welfare into sustainable practices. The study model's social welfare is founded on the allocation of corporate resources towards social responsibility initiatives, specifically in the case of Dangote cement. Corporate Social Responsibility (CSR) expenditure serves as a significant measure of a company's sustainability endeavors as it showcases a definite dedication to sustainability. Through their investment in CSR initiatives, companies demonstrate their recognition of the environmental and social consequences of their business activities and their commitment to mitigating them. Corporate social responsibility (CSR) expenditure can also be quantified over some time, enabling companies to evaluate the effectiveness of their sustainability initiatives and make informed choices to enhance their sustainability practices. Moreover, corporate social responsibility (CSR) expenditure plays a direct role in addressing environmental, social, and governance (ESG) concerns by allowing companies to invest in projects that tackle sustainability challenges. These efforts encompass the reduction of greenhouse gas emissions, the advancement of employee diversity and inclusion, and the enhancement of labor standards in supply chains. Furthermore, allocating resources toward corporate social responsibility (CSR) initiatives can bolster a company's standing and appeal to stakeholders who prioritize sustainability. Furthermore, the adoption of sustainable practices can result in enduring financial advantages such as waste reduction and resource optimization, ultimately leading to cost savings for a company over an extended period. In essence, companies can strategically position themselves to tackle global challenges like climate change by prioritizing their CSR spending, which can greatly affect their business operations.

3.4 Environment

An exemplary sustainable practice is the acknowledgment of environmental practices that contribute to sustainability. For this purpose, this study employs CO2 emissions as an indicator of sustainable practices. A crucial element of sustainability is the mitigation of greenhouse gas emissions, with a particular focus on reducing carbon dioxide (CO2). Carbon dioxide (CO2) is the predominant greenhouse gas that is primarily responsible for the ongoing climate crisis. This crisis is already causing significant environmental, social, and economic consequences on a global scale. Hence, quantifying CO2 emissions is a crucial measure in ascertaining sustainable practices. Quantifying CO2 emissions enables governments and organizations to monitor their advancements in emission reduction and the attainment of sustainability objectives. The reason for this is that the reduction of CO2 emissions necessitates substantial alterations in energy generation, transportation, and industrial procedures, all of which are vital to economic progress. Through the measurement of CO2 emissions, we can pinpoint regions with notably elevated emissions and concentrate our efforts on implementing efficacious strategies to mitigate them. As an illustration, governments can foster the advancement of sustainable energy sources, advocate for the efficient use of energy, and allocate resources towards the enhancement of public transportation systems to mitigate emissions stemming from automobiles. Furthermore, the act of quantifying CO2 emissions can assist organizations in recognizing their ecological footprint and implementing measures to mitigate it. Businesses can incorporate sustainability practices into their operations, such as implementing measures to decrease energy consumption in buildings, minimizing waste generation, or transitioning to environmentally friendly products.

3.5 Dependent variable

3.5.1 Financial efficiency

The study uses revenue as an indicator to measure financial efficiency as it provides insight into a company’s financial performance. Again, revenue helps determine a company's tax obligation and contributions towards society and stakeholders thus providing a comprehensive indicator to measure financial efficiency.

3.5.2 Operational efficiency

The study employs operational efficiency as a metric to assess performance, as it quantifies an organization's ability to effectively utilize its resources in the production of goods or services. An organization that can achieve greater output using the same input, or maintain the same output while using less input, is regarded as having superior operational efficiency. These benefits can be quantified in terms of reduced expenses, enhanced efficiency, accelerated delivery schedules, and improved quality of products or services. Through the surveillance and enhancement of operational efficiency, an organization can enhance its profitability, diminish expenses, and attain a competitive advantage in the market. Hence, operational efficiency serves as a crucial metric for assessing the overall performance of a company.

3.5.3 Analytical Procedure

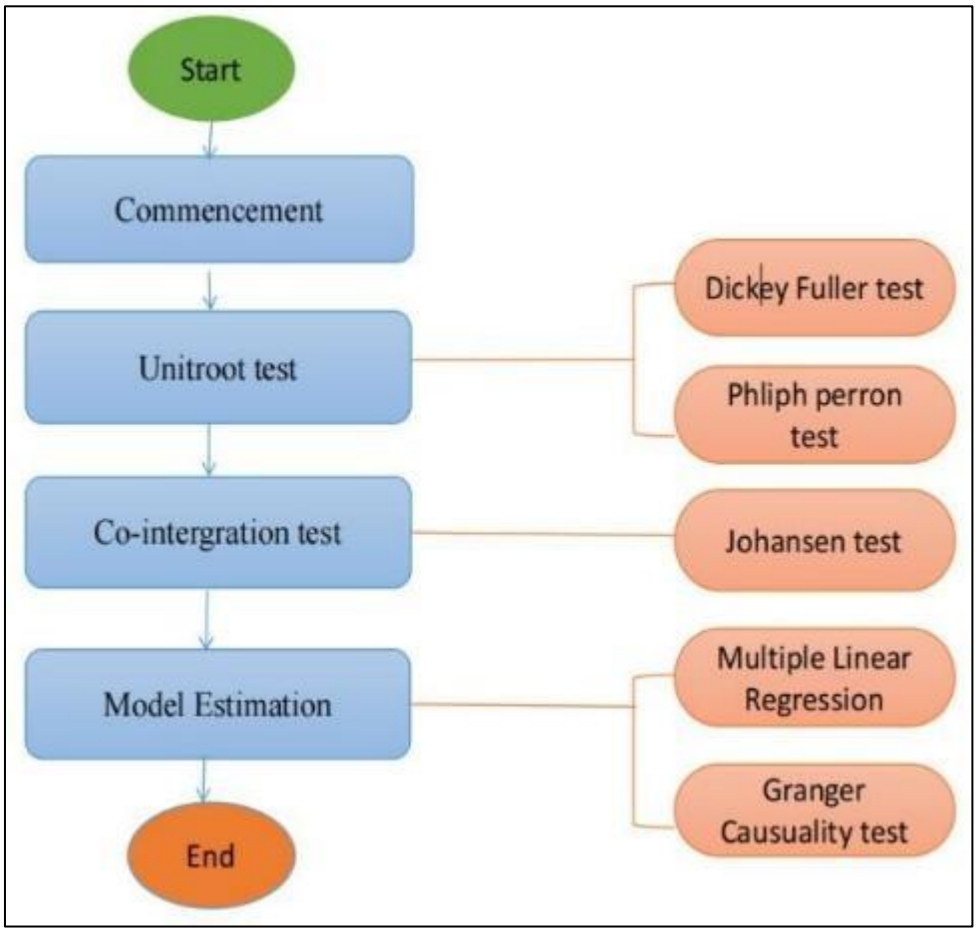


Figure 1: Analytical Procedure for the Empirical Analysis

3.5.4 Unit root test

The unit root test is a statistical method employed to ascertain whether a time series is stationary or non-stationary. Stationarity refers to the property of a series where its mean and variance remain constant over time, while non-stationarity implies that the mean and variance of the series change. Nevertheless, pseudo-regression can lead to deceptive findings in the analysis of panel data, highlighting the significance of stability measures. Unit root tests are commonly employed to assess long-term stability due to their effectiveness in identifying it. The test entails examining the presence of a unit root in the series, which occurs when the autoregressive coefficient is equal to one. A series that exhibits a unit root demonstrates a non-stationary pattern, which can be either a trend or a random walk. False conclusions in statistical analysis may arise when the series exhibits a unit root, resulting in spurious regression. Various unit root tests, such as the ADF, PP, and KPSS, are accessible. These tests serve the purpose of identifying the existence of a unit root, but they vary in terms of assumptions and implementation. The ADF test, which is widely employed, compares the autoregressive coefficient to a critical value. If the coefficient exceeds this value, it indicates that the series is stationary. If the value is lower, the series is considered non-stationary. This study tests two tests, namely the CADF and CIPS, introduced by Pesaran (2007), to examine stationarity in panel data that exhibit cross-sectional dependence. The study employs the Dickey-Fuller and Philip Perron tests to assess the stationarity of the parameters under investigation. Utilizing the Dickey-Fuller and Philip Perron tests is a prevalent method in time-series analysis for assessing the stationarity of data. The Dickey-Fuller and Philip Perron tests are dependable statistical instruments for assessing the stationarity of the data. These tests are used to determine whether a time-series data set exhibits stationarity or non-stationarity. The outcomes of these tests can assist in determining the feasibility of conducting additional analysis and identifying the appropriate statistical models for the given data set.

3.6 Co-integration test

The co-integration test is a statistical method used to ascertain whether two or more time series are co-integrated. Cointegration is the term used to describe the existence of a common random trend among non-stationary variables for an extended duration (Islam, 2022). It is a commonly employed concept in the fields of economics and finance to identify enduring connections. The approach utilizes regression analysis to establish the correlation between different time

series. Co-integration signifies that the variables' long-term patterns will align, regardless of any temporary fluctuations (Fang et al., 2022). The co-integration test involves several steps, such as choosing a time series for analysis, performing stationarity tests to identify non-stationarity, estimating the regression model, and employing methods like Johansen's test to examine co-integration. The Johansen test is a multivariate method capable of identifying multiple co-integrating relationships. To assess the existence of a consistent and enduring relationship between the variables, this study employs the Johansen Johansen-Fisher co-integration test to determine the long-term correlation between the parameters under investigation. This technique will aid in determining whether the variables exhibit a durable correlation or not.

3.7 Model Estimation

To examine the relationship between the variables, we initially evaluated a multiple linear regression model. Afterwards, we evaluated the Variable Autoregressive Model (VAR model). Once we confirmed the dependability and importance of the variables in the Var model, we proceeded to evaluate the Granger causality test.

4 EMPIRICAL RESULTS AND ANALYSIS

Table 2: Demographics of Employees

Categories of employees by contract	Frequency	Percentage (%)
Permanent	8530	90
Temporary	571	6
Expatriates	407	4
Age group		
18-30	1089	11.39
31-50	6766	70.79
50 and above	1703	17.82

4.1 Variable Statistics

Table 3 presents the summary statistics for the variables used in the study. The data shows that financial efficiency (LNFIN) has the highest average value of 15.53392, while operational efficiency (LNOPR) has the lowest average value of 3.118816. LNFIN has the highest average value among the variables, while LNOPR has the lowest average value. LNFIN exhibits the greatest variability in terms of both standard deviation (1.265415) and variance (1.601274), suggesting a high level of dispersion in the data. The social welfare (LNSOC) variable exhibits the smallest standard deviation (0.114526) and variance (0.013116), indicating that the data is highly concentrated around the mean.

Regarding skewness, it is noted that LNFIN and LNSOC exhibit negative skewness values, suggesting that the majority of the data is concentrated to the left of the mean. The LNPRO and LNENV variables exhibit a slightly negative skewness, indicating a slight leftward skew. On the other hand, the LNOPR variable has a skewness value close to zero, indicating that the data is nearly symmetrical. Regarding kurtosis, it is evident that all five variables exhibit kurtosis values exceeding 1, indicating their tendency towards leptokurtosis. LNFIN exhibits the highest kurtosis value of 3.662299, while LNSOC displays the highest variance in kurtosis at 4.485262. This indicates that the distributions of LNFIN and LNSOC are more peaked compared to a normal distribution.

Table 3: Variable Statistics

Variable	Mean	std. dev.	Min	Max	Variance	Skewness	Kurtosis
LNSOC	7.83777	0.114526	7.548029	7.978539	0.013116	-1.222193	4.485262
LNPRO	12.77494	0.4771355	11.85889	13.37111	0.227658	-0.5581313	2.211491
LNENV	11.11192	0.3147546	10.55441	11.52811	0.09907	-0.3606972	1.956399
LNFIN	15.53392	1.265415	12.6346	16.91023	1.601274	-1.318631	3.662299
LNOPR	3.118816	0.1666806	2.850707	3.36461	0.027782	-0.0862034	1.854694

Note: LNSOC= social, LNPRO= procurement, LNENV= environment, LNFIN= financial efficiency and LNOPR= operational efficiency.

4.2 Initial correlations

Table 4 displays the initial correlation between the variables examined in the study. The results indicate a strong positive relationship between operational efficiency and financial efficiency, where a one-unit increase in operational efficiency corresponds to a 77% increase in financial efficiency. It is not surprising, as previous research has shown a clear and meaningful correlation between operational efficiency and financial efficiency (cite). Table 4 demonstrates a direct correlation between environmental practice, sustainable procurement, and financial efficiency, with percentages of 78% and 79% respectively. Both environmental practices and sustainable practices had a positive impact on financial efficiency. However, sustainable practices had a stronger influence compared to environmental practices. Conversely, corporate social spending, which represents social welfare, has a negative correlation with financial efficiency. Logically, an incremental rise in CSR expenditure will result in a 66% decline in financial effectiveness.

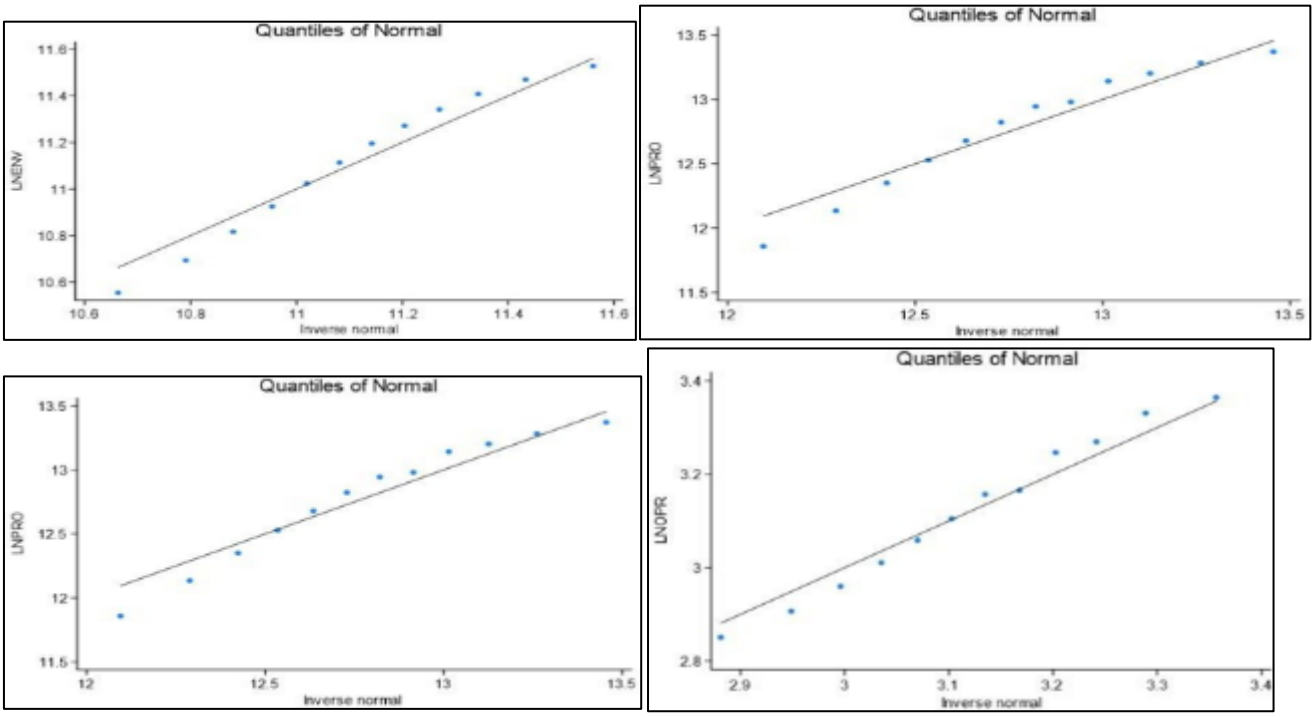
Table 4: Correlations table.

	LNFIN		**LNOPR**	**LNENV**	**LNPRO**	**LNSOC**	
LNFIN		1					
LNOPR		0.7714	1				
LNENV		0.7815	0.9923	1			
LNPRO		0.7905	0.9853	0.9967	1		
LNSOC		-0.6378	-0.8558	-0.8371	-0.8221		1

Note: LNFIN= financial, LNOPR= operational efficiency, LNENV= environment, LNPRO= procurement, and LNSOC= social.

4.3 Normality test

The q-q plots provide evidence of the normal distribution of the variables in the study. The result indicates that all the variables exhibit a normal distribution. Upon examining the q-q plots of the variables in the study, it was concluded that all the variables exhibited a normal distribution. This indicates that the data points for each variable exhibit a high degree of linearity, suggesting that they are uniformly distributed around the mean and accurately represent a normal distribution.



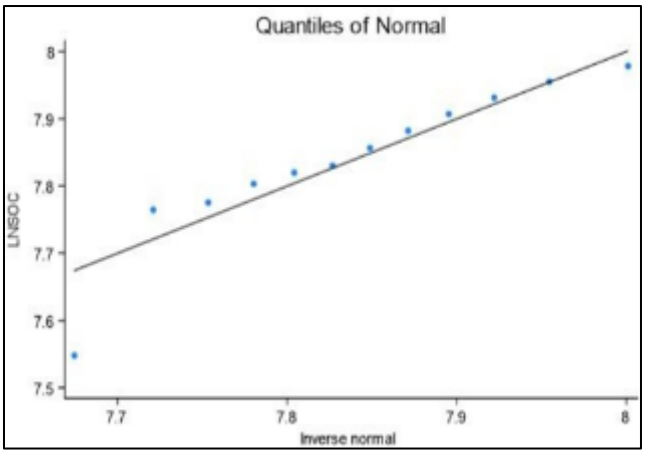


Figure 2: Trends and Temporal Behaviour of the Study Variables

The study assessed the line of variables to determine their trends and behaviour over time. The outcome is The graph depicted in the attached image illustrates a series of data points that portray the temporal behavior of the variables under investigation. The graph exhibits a consistent pattern, as the data points are uniformly distributed and the line appears to have a minimal slope. This implies that the variables demonstrate a consistent pattern without any notable fluctuations or deviations. The consistent pattern observed in the variables can have multiple implications. Firstly, it signifies that the variables exhibit a consistent and foreseeable pattern over time. The predictability of these variables can be advantageous for making well-informed decisions and formulating strategies based on their anticipated behavior. Furthermore, the consistent pattern indicates that the variables may possess a degree of stability or balance. This can be valuable for comprehending the fundamental factors or dynamics that contribute to the consistent behavior of the variables. Additionally, it suggests that the variables are not significantly affected by external factors or disturbances, which enhances the reliability of the analysis and forecasting.

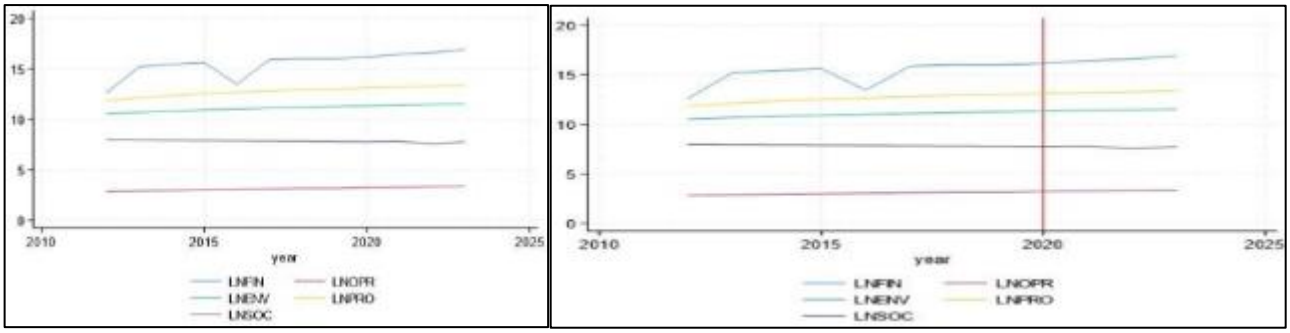


Figure 3: Temporal Trends of the Study Variables

From the provided graph, it is evident that all the financial indicators for Dangote Cement exhibit a consistent upward trend. The lines representing the indicators, specifically LNOPR, LNFIN, LNENV, LNSOC, and LNPROF, are all exhibiting an upward trend. The graph indicates a positive trend in the financial performance of Dangote Cement over the specified period.

4.4 Unit root test

Ensuring the stability of time series data is crucial in order to prevent the occurrence of misleading pseudo-regression findings (Parzen Emanuel, 1961). The unit root test is a frequently employed technique to assess long-term stability in study parameters. The stability of the variable sequence was verified in this study through the utilization of Dickey-Fuller and Philip Perron tests. The results demonstrated that all variables successfully met the criteria of the tests, resulting in the rejection of the null hypothesis (H0). Table 5 indicated that all variables exhibited stability, non-stationarity at levels, and stationarity at first differences. This implies that the variables demonstrate a stable correlation over a period of time, and slight deviations can be effectively addressed through short-term tactics. Although the results suggest possible cause-and-effect relationships between the variables, additional research is necessary to establish the specific direction of causation. The study demonstrates that the independent variables have a significant impact on the dependent variable, emphasizing their importance in elucidating the variations observed in the dependent variable.

Table 5: Dickey-Fuller and Phillips-Perron Unit Root Test Results

	Dickey-Fuller				**Philip Perron**			
Variables	Levels	Decision	1st Diff.	Decision	Levels	Decision	1st Diff.	Decision
LNFIN	0.79	I (0)	-3.25	I (1)	-3.195	I (1)	-7.542	I (1)
LNOPR	6.022	I (1)	6.022	I (1)	11.02	I (1)	-3.111	I (1)
LNENV	-1.609	I (0)	-4.876	I (1)	7.809	I (1)	-10.535	I (1)
LNSOC	0.322	I (0)	-3.12	I (1)	-0.952	I (0)	-5.716	I (1)
LNPRO	1.634	I (0)	-2.404	I (1)	5.037	I (1)	-2.652	I (1)

Note: LNFIN=Financial, LNOPR= operational efficiency, LNENV= environment, LNSOC= social, and LNPRO= procurement.

4.5 Co-integration test

After assessing the stationary of the study's parameters, it is essential to

Table 6: Cointegration Test Results Using the Trace Statistic

	No. of	**Trace**	**Value**
Panel	CE(s)	stat.	5%
	None	474.2000	68.52
	At most 1	278.8000	47.21
	At most 2	115.4000	29.68
	At most 3	41.4100	15.41
	At most 4	21.6000	3.76
	At most 5	28.7800	

4.6 Model estimation

The table displays the coefficients, standard errors, t-stats, p-values, and 95% confidence intervals for a multiple linear regression model that predicts the natural logarithm of financial performance (LNFIN) using four independent variables: natural logarithm of operating profit (LNOPR), natural logarithm of environmental factors (LNENV), natural logarithm of social factors (LNSOC), and natural logarithm of productivity (LNPRO). The findings indicate that all four independent variables exert a substantial influence on the dependent variable, LNFIN. The coefficient for LNOPR is 5.857 with a p-value of 0.003. The coefficient for LNENV is 3.142 with a p-value of 0.003. The coefficient for LNSOC is -7.047 with a p-value of 0.026. Lastly, the coefficient for LNPRO is 2.096 with a p-value of 0.002. The regression model incorporates a constant term, which has a coefficient of 70.765 (p-value = 0.007). The R-square value of 0.6118 signifies that the model accounts for 61.18% of the variability in LNFIN, indicating a moderate to strong association between the independent and dependent variables. The adjusted R-square value of 0.5255 indicates that 52.55% of the variability in the dependent variable can be accounted for by the independent variables, taking into account the number of independent variables in the model.

The findings suggest that implementing sustainable changes has a beneficial and noteworthy effect on Dangote Cement, regardless of their level of income. The LNOPR estimator shows a result of 5.857, indicating a 5-unit rise in LNFIN (the financial aspect) and a 3.142 rise in LNENV (the environmental aspect). In contrast, LNSOC exhibits a reduction of 7, indicating a decline in the social dimension. These findings indicate that implementing sustainable changes is increasingly beneficial for the company's financial performance. Anticipated is the ongoing growth in the financial influence of sustainability initiatives at Dangote Cement.

Table 7: Multiple linear regression

LNFIN	Coefficient	Std. Err	t-stats	p>t	95% conf. interval
LNOPR	5.857	1.528	3.83	0.003	2.453
LNENV	3.142	0.793	3.96	0.003	1.374
LNSOC	-7.047	2.691	-2.62	0.026	-13.043
LNPRO	2.096	0.514	4.08	0.002	0.952
cons	70.765	21.095	3.35	0.007	23.762
R-square	0.6118				
Adjusted R-squared	0.5255				
Root me	0.87165				

5 CONCLUSION

The study has profound implications across multiple dimensions. It offers valuable analysis of the company's sustainability initiatives, emphasizing potential for strategic enhancements and influence within the industry. The study's favorable results can bolster the company's standing, allure socially conscious investors, and enhance market positioning by fostering stronger community relationships through enhanced engagement efforts, thereby contributing to social progress in local regions. Implementing these initiatives can establish Dangote Cement as a front-runner in sustainable practices, resulting in advantages for both the environment and the company's long-term sustainability.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

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