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IMPACT OF CIRCULAR PRODUCTION STRATEGY ON THE SUSTAINABILITY OF CONSUMER GOODS MANUFACTURERS LISTED ON THE NIGERIAN STOCK EXCHANGE

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Abstract
This study investigates the impact of the circular production strategy on the sustainability of consumer goods manufacturers (CMGs) listed on the Nigerian Stock Exchange (NSE). The study employs a quantitative positivist research approach with a sample size of 566 drawn from a population of 21 manufacturers with a total staff strength of 22,504. The study is guided by Carroll's Corporate Social Responsibility (CSR) theory and the Cradle-to-Cradle theory and utilized Partial Least Squares Structural Equation Modeling (PLS SEM) for data analysis.The studyfound that the redesign strategy of circular productionpositively affects social and environmental performance. However, the redesign strategy was found to not have a positively significant relationship with economic performance.The study recommended that manufacturers should prioritize circular design and explore pricing models that capture the value of sustainable products while policymakers should incentivize redesign initiatives through tax breaks.

Keywords: Circular production,RedesignStrategy, Sustainability, Consumer Goods Manufacturers, Corporate Social Responsibility, Cradle to Cradle theory.

Introduction

The majority of global production operates in a linear manner, involving the extraction of raw materials, production, and disposal, which leads to unsustainable levels of waste and environmental harm (Anwar et al., 2021). This approach contributes to issues like rising sea levels, increased flooding, and plastic pollution in oceans, which adversely affect marine ecosystems and industries reliant on coastal areas, such as tourism and fishing. In addition to challenges like climate change, poverty, and supply chain disruptions, businesses also face obstacles such as land degradation, deforestation, and water scarcity (Crowther &Quoquab, 2023). Factors like the Covid-19 pandemic and geopolitical conflicts further increase production costs, resulting in higher consumer prices and reduced purchasing power worldwide. In Nigeria, fluctuating exchange rates add to these challenges, making short-term planning difficult for businesses (Maione, 2021).

In response to these challenges, the concept of the circular economy has emerged as a promising framework, emphasizing resource efficiency, waste reduction, and closed-loop systems, contrasting with the traditional linear model. Within this framework, the consumer goods manufacturing sector holds significant importance due to its environmental impact and influence on consumption patterns (Bjørnbet et al., 2021). Nigeria, being one of Africa's largest economies, faces specific sustainability challenges and opportunities, particularly within its consumer goods manufacturing industry (Binuyo et al., 2019). The country's growing population and urbanization have driven up demand for consumer goods, intensifying pressure on natural resources and exacerbating environmental impacts. To address this, many consumer goods manufacturers in Nigeria are exploring and implementing circular production strategies aimed at reducing waste and conserving resources.

This study aims to contribute to the understanding of how circular economy principles can promote sustainable development in emerging economies, focusing on the adoption and outcomes of circular practices within the Nigerian context. Additionally, it aims to explore how circular production

strategies intersect with consumer goods manufacturing in Nigeria, adding to the body of literature on sustainable development and offering insights into practical strategies for enhancing sustainability within the industry (Kaya et al., 2023).

i. To examine the influence of redesign strategy on economic performance of consumer goods manufacturers listed on the NSE.
ii. To examine the influence of redesign strategy on social performance of consumer goods manufacturers listed on the NSE.
iii. To examine the influence of redesign strategy on environmental performance of consumer goods manufacturers listed on the NSE.

The rest of thestudy is structured as follows: A literature review of the circular production redesign concept and sustainability, drawing on previous research and theoretical frameworks. Next, the methodology section outlines the research approach used,and then a conclusion with a summary of key findings and implications for practice and policy.

Literature Review

Conceptual definition

The concept of the circular economy has garnered increasing attention in academic literature and policy discourse as a promising framework for achieving sustainable development. Rooted in the principles of resource efficiency, waste reduction, and closed-loop systems, the circular economy represents a shift away from the traditional linear "take-make-dispose" model towards a more regenerative and restorative approach to economic production and consumption.

Central to the circular economy concept is the idea of decoupling economic growth from resource consumption and environmental degradation (Stahel, 2016). Consequently, Lewandowski (2016) posits that this can best be achieved through a total redesign of production systems to include circularity principles. Also, by prioritizing the preservation and circulation of resources within the economy, circular production strategies aim to minimize waste generation, conserve natural resources, and reduce the environmental footprint of economic activities (MacArthur, 2012).

Redesign

The most significant of the 3Rs of the circular productionis the redesign initiative. Here, manufacturers are encouraged to go back to the drawing board and design a product that requires less raw material to begin with, has a longer life span, can easily be refurbished at end of life, decoupled, or recycled. Hence, Kirchherr et al (2017) added that redesign strategy is the backbone of circular economy because it provides the platform fordesigning products for longevity and recyclability, promoting resource recovery and recycling, and fostering closed-loop systems where materials are continuously reused and regenerated.

The relevance of the redesign strategy to sustainability is underscored by its potential to address pressing environmental challenges such as climate change, biodiversity loss, and pollution (European Commission, 2020; as cited in Mazur-Wierzbicka, 2021). Numerous studies have highlighted the environmental benefits of adopting redesign strategy across various sectors, including manufacturing, agriculture, construction, and transportation (Geissdoerfer et al., 2017; Bocken et al., 2016).

Sustainability

Sustainability in business is all about securing the short-, medium-, and long-term future of the organization. In light of this, John Elkington proposed the Triple Bottom Line (TBL) framework. The TBL challenges traditional business accounting practices that solely focus on economic or financial performance. It proposes a more comprehensive framework that considers a company's performance across three dimensions: economic, social, and environmental.

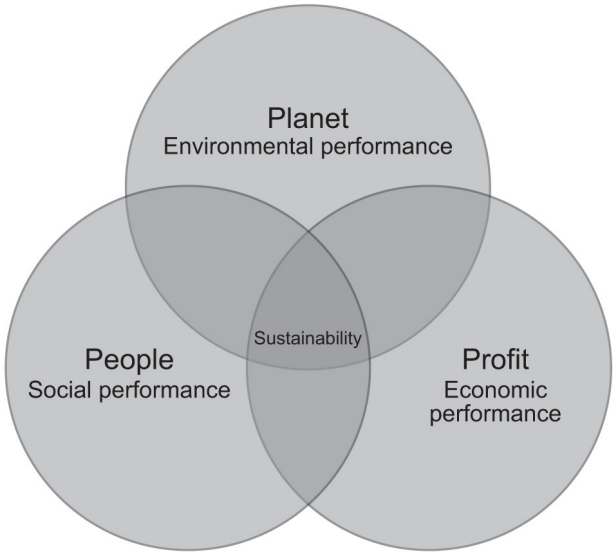

Figure 1.1 The Sustainability Matrix

The TBL framework acknowledges the traditional focus on economic performance. This dimension incorporates metrics like revenue, expenses, profitability, and shareholder value. However, by integrating environmental and social considerations, companies can potentially drive innovation that leads to cost savings and new business opportunities (Bosona, 2020). For example, focusing on resource efficiency can reduce energy and water consumption, and developing products with a lower environmental impact can open up new markets.

Also, in the context of the triple bottom line, economic performance can mean more than just how much money a business makes. According to Hammer and Pivo (2017),a business must emphasize the importance of long-term financial health and resilience. Businesses need to make strategic decisions that ensure their continued success and growth over time, considering factors such as market trends, technological advancements, and changing consumer preferences. It must also ensure it earns its income in ethical, fair manners. This includes soliciting business partners and vendors with which it aligns philanthropically.

The social dimension brings the human element into play. It considers a company's impact on its employees, customers, and the broader community. Employee well-being, fair wages, safe working conditions, diversity and inclusion practices all fall under this umbrella. Social performance also encompasses customer satisfaction, ethical sourcing practices, and community engagement initiatives (Andersson et al., 2022). A strong social performance can enhance a company's brand reputation and attract customers and investors who value these aspects.

Finally, the environmental dimension emphasizes a company's impact on the planet. This includes factors like resource consumption (energy, water, raw materials), waste generation (pollution, emissions), and the overall environmental footprint of the company's operations (Bogardi et al., 2012). By focusing on these aspects, companies can identify and mitigate potential environmental risks associated with resource scarcity, stricter regulations, and the potential for climate change disruptions.

While the TBL framework offers a more holistic approach to business success, there are challenges associated with its implementation. Standardizing measurement remains an issue, as there's no single universally accepted way to quantify a company's performance across these three dimensions (Heshmati, 2017). Different companies may use different metrics and weighting systems, making comparisons difficult. Additionally, collecting and analyzing data on environmental and social impacts can be complex and resource intensive. Finally, integrating TBL considerations into core business strategies and decision-making processes requires a shift in corporate culture and ongoing commitment from leadership.

Overall, the Triple Bottom Line encourages a more responsible and sustainable approach to business. It compels companies to operate in a way that considers their impact on the environment,their employees, and the communities they operate within, while still maintaining economic viability. This long-term perspective aims to ensure business success that benefits all stakeholders and the planet for the future.

The Conceptual Framework

Conceptual frameworkacts as a blueprint for the research. It outlines key concepts, variables, and their potential relationships, essentially explaining what you expect to discover and how the different pieces of your study might fit together. The conceptual framework in figure 2.1 depicts the redesign strategy as a dimension of circular economy and how it influences the economic, social, and environmental performance of consumer goods manufacturers listed on the NSE.

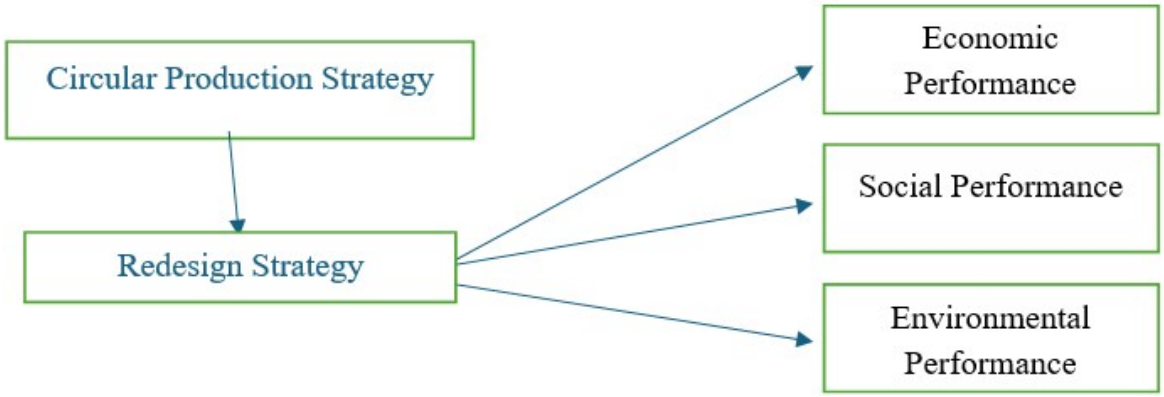

Figure 2.1 Conceptual Framework.

Theoretical Framework

The Cradle to Cradle (C2C) design philosophy and Carroll's Corporate Social Responsibility (CSR) pyramid are interwoven to create a robust theoretical framework for analyzing business practices. Here's how they work together to provide a comprehensive picture of sustainability.

Cradle to Cradle emphasizes designing products and systems that are inherently good for the environment. It promotes a cyclical approach where materials are continuously cycled back into productive use, eliminating the concept of waste. This design philosophy prioritizes innovation and the creation of safe, non-toxic materials that can be safely returned to the biosphere or reused in technical cycles.

Carroll's CSR pyramid, on the other hand, offers a hierarchical framework for CSR, encompassing economic, legal, ethical, and philanthropic responsibilities. These responsibilities build upon each other, with the foundation being economic viability. Businesses have a basic obligation to generate profit and remain operational. Next comes legal compliance, ensuring adherence to all relevant laws and regulations. Moving beyond legal requirements, companies should also operate ethically, considering the expectations of society for responsible business practices. Finally, Carroll's pyramid incorporates philanthropic contributions and social initiatives, encouraging businesses to give back to society.

The synergy between these two frameworks lies in how C2C principles directly contribute to fulfilling Carroll's CSR pyramid. By minimizing waste and maximizing resource use, C2C practices can enhance efficiency and potentially lead to cost savings, thus strengthening the economic foundation of a business. Additionally, C2C design helps businesses comply with environmental regulations and potentially avoid pollution-related fines, addressing the legal aspects of CSR. Furthermore, C2C goes beyond legal compliance, promoting environmentally responsible practices that align with societal expectations for sustainability, addressing the ethical dimension of CSR.

Finally, by adopting a closed-loop system and minimizing environmental impact, companies that embrace C2C principles contribute to a healthier planet, which can be seen as a form of societal philanthropy.

Consequently, combining C2C and Carroll's CSR theory creates a powerful framework for businesses to analyze their impact and strive for a more sustainable future. It encourages not just avoiding waste but creating safe materials for continuous cycles. This framework can be particularly useful for research on sustainable business practices, product design, and supply chain management.

Empirical Review

A study by Smith et al. (2018) found that manufacturers that implemented product redesign initiatives achieved substantial reductions in energy consumption and greenhouse gas emissions. Similarly, research by Chen et al. (2020) demonstrated that adopting eco-design principles resulted in decreased material usage and improved eco-efficiency in manufacturing processes. Another study by Jones and Lee (2019) found that companies that prioritized product redesign to enhance safety and usability reported higher levels of employee satisfaction and community trust. Additionally, research by Wang et al. (2021) highlighted the role of design for social innovation in fostering inclusive growth and poverty alleviation in manufacturing communities.

Similarly, a study by Lee and Choi (2017) found that companies that implemented design for manufacturability (DFM) practices experienced lower production costs and higher profitability compared to non-adopters.

In the context of consumer goods manufacturing, the circular economy offers significant opportunities for enhancing sustainability and reducing environmental impact. The consumer goods sector is characterized by high resource consumption, extensive supply chains, and complex product life cycles, making it particularly conducive to circularity interventions (Teece et al., 2016). Circular strategies such as product design for disassembly, remanufacturing, and extended producer responsibility have the potential to reduce waste, conserve materials, and create value throughout the product lifecycle (Bocken et al., 2017).

Research specific to the Nigerian context is limited, but emerging literature suggests growing interest and adoption of circular economic strategies among consumer goods manufacturers in the country. Nigeria's National Circular Economy Policy and Strategy, launched in 2019, outlines the government's commitment to promoting circularity across various sectors, including manufacturing, waste management, and agriculture (Ezeudu&Ezeudu, 2019).

However, challenges such as inadequate infrastructure, limited awareness, and policy gaps pose barriers to the widespread implementation of circular strategies in Nigeria (Ibidunni et al., 2020).Overall, the literature highlights the potential of the circular economy to transform the consumer goods manufacturing sector towards greater sustainability.

Methodology

The study adopts a survey research design. This approach allows for the collection of standardized data from a large sample of CGMs, facilitating the statistical analysis of relationships between circular strategies and sustainable performance.

The target population for this study comprises all the 21 listed CGMs on the Nigerian Stock Exchange with a total staff strength of 22,504. While the Taro Yamani formula initially suggested a sample size of 393, this study proposes increasing the number to 566 because of low response rate anticipation. As highlighted in the study by Adomi et al. (2007), individuals in Nigeria may be less likely to complete surveys. Also, collecting data from more staff of CGMs allows for a more comprehensive understanding of CE practices and sustainability efforts within the Nigerian consumer goods sector.

The data was gathered through a self-administered survey distributed to listed CGMs on the Nigerian Stock Exchange (NSE) that are located in Abuja and Lagos. This is because a significant concentration of Nigerian CGMs are located in these two cities and manufacturers in these locations

tend to cater to the national market, potentially offering a broader perspective on CE practices and its result. Also,given the relative novelty of CE practice in Nigeria, targeting individuals directly involved in relevant departments is crucial. Hence, within each CGM selected, individuals from the following departments were purposively selected to participate in the survey: Supply Chain, Finance, Production, Sales, and Human Resources. This is because these departments are likely to possess the most relevant knowledge and experience regarding CE practices within their areas of responsibility. Finally,a five (5) point Likert's scale was employed for the questionnaire to provide balance and neutrality to the respondents should they choose to remain neutral in some questions. Finally, the model for the study is grounded in the Carrols CSR theory and the Cradle-to-Cradle theory of Production to provide a robust foundation for analysis. Hence, the model for the study is mathematically represented as follows:

$SC = \beta0 + \beta1\ RR + \varepsilon$
$EN = \beta0 + \beta1\ RR + \varepsilon$
$EC = \beta0 + \beta1\ RR + \varepsilon$
Where, $\beta0$ = ConstantSC = SocialEN = EnvironmentalEC = EconomicRR = Reduce
ε = Error term

4. Resultsand Analysis

This study examined the correlation between redesign strategy and the sustainable performance of consumer goods manufacturers listed on the NSE. The data collected from respondents was analyzed, beginning with the codification of the data into SPSS version 25. The analysis comprised descriptive statistics and inferential statistics.

4.1 Descriptive Statistics (Mean, Standard Deviation, and Normality Test)

This analysis was conducted to determine the normality of the questionnaires, calculate the respondents' means and standard deviations, and assess the mean gaps in the redesign strategy and sustainable performance. Mean and standard deviation were utilized as descriptive statistics for ratio and interval scales. According to Nik et al. (2010), response rates of 2.33 and below are categorized as low-level, while rates between 2.34 and 3.66 are considered moderate. Rates of 3.67 and above are classified as high-level.

The data presented in Table 1 indicate that economic performance has the highest average mean value, with a mean of 4.49 and a standard deviation of 0.344. In contrast, the redesign strategy is found to have the lowest average mean value, with a mean of 4.45 and a standard deviation of 0.387.

Table 1: Descriptive Statistics

Constructs	Items	Mean	SD
Social Performance	7	4.473	.357
Environmental Performance	7	4.435	.365
Economic Performance	6	4.488	.344
Redesign Strategy	6	4.450	.387

4.2 Correlation Analysis

Correlation analysis is a statistical technique utilized to evaluate the strength and direction of relationships between variables. According to Pallant (2011), a correlation coefficient of zero suggests no relationship, while a coefficient of one (±1) indicates a strong positive or negative relationship. However, a coefficient exceeding 0.9 suggests the presence of multicollinearity. The results presented in Table 2 demonstrate that the correlation analysis conducted on the variables produced statistically significant outcomes at a significance level of 0.05 (p=0.000), without evidence of multicollinearity.

Table 2: Correlation Analysis

Constructs	SC	EN	EC	RR
Social Performance (SC)	1			
Environmental Performance (EN)	.493**	1		
Economic Performance (EC)	.410**	.442**	1	
Redesign (RD)	.453**	.631**	.364**	1

**. Correlation is significant at the 0.01 level (2-tailed).

4.3 Measurement model

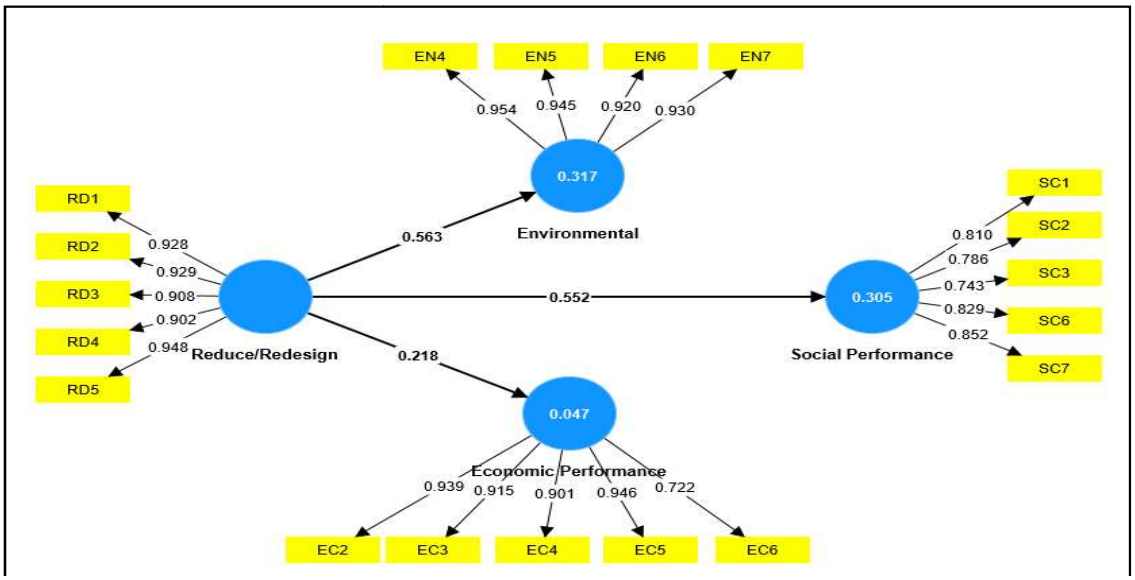

Figure 2: Measurement Model

Before testing hypotheses, a strong foundation is needed. Hair et al. (2019) emphasizes reliability and validity measurement. Reliability is assessed by the composite reliability coefficient, which should exceed 0.7 for each construct. Additionally, factor loadings above 0.6 and an Average Variance Extracted (AVE) exceeding 0.5 indicate good convergent validity. Discriminant validity ensures the constructs are distinct. Chin (1998) suggests the square root of each AVE should be greater than the correlations between constructs. Validating these aspects ensures a solid foundation for hypothesis testing. Details of this study's measurement model can be found in Figure 2 and Table 3.

Table 3: Summary of Measurement Model (Reliability and Convergence Validity)

Constructs	Items	Loadings	CR	AVE
Environmental Performance	EN4	0.954	0.954	0.878
	EN5	0.945		
	EN6	0.920		
	EN7	0.930		
Social Performance	SC1	0.810	0.869	0.648
	SC2	0.786		
	SC3	0.743		
	SC6	0.829		
	SC7	0.852		

Economic Performance	EC2	0.939	0.932	0.790
	EC3	0.915		
	EC4	0.901		
	EC5	0.946		
	EC6	0.722		
Redesign Strategy	RD1	0.928	0.957	0.852
	RD2	0.929		
	RD3	0.908		
	RD4	0.902		
	RD5	0.948		

4.4 Discriminant Validity

This shows the extent to which constructs are different from each other (Ab Hamid et al., 2017). The Heterotrait-monotrait ratio (HTMT) was used to calculate the discriminant validity because of its high sensitivity in detecting correlation issues (Voorhees et al., 2017). According to Henseler et al. (2009), if the HTMT value is below 0.9, it shows no correlation problem. Thus, HTMT value in this study (0.404 – 0.862) are acceptable. seetable 4 below.

Table 4: Discriminant Validity (HTMT) Result

Constructs	EN	SC	EC	RD
Environmental Performance				
Social Performance	0.410			
Economic Performance	0.862	0.404		
Redesign Strategy	0.741	0.591	0.701	

4.5 Structural Model (Testing of Hypotheses)

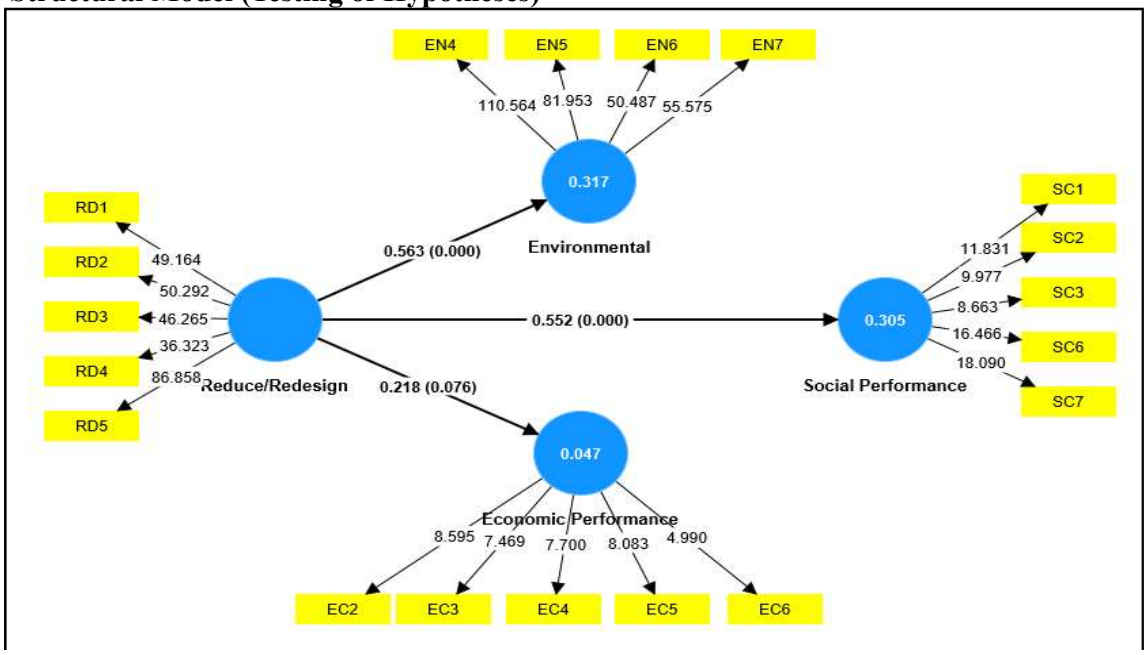

Figure 2: Structural Model (Bootstrapping @5000)

This study conducted an analysis of the overall structural model and hypothesis testing. The R-squared values indicate the amount of variance in each outcome variable (environmental, social, and economic performance) that is explained by the predictor variables in the model. A higher R-square value indicates a stronger explanatory power of the model. In this case, the R-square values for environmental performance, social performance, and economic performance are 0.317, 0.305, and 0.047, respectively. These values suggest that the model constructed has a substantial explanatory power, meaning that a significant portion of the variability in each performance measure can be accounted for by the predictor variables included in the model.

Furthermore, the path coefficients in the structural model represent the strength and direction of the relationships between the predictor variables and the outcome variables. These path coefficients were tested for significance using bootstrapping with 5000 iterations. The standardized path coefficients, along with their corresponding t-values and hypothesis test results, indicate whether the relationships between variables are statistically significant.

Figure 2above and Table 5 below present the results of the structural model, including the path coefficients, t-values, and hypothesis test outcomes, providing a comprehensive overview of how

the predictor variables influence the environmental, social, and economic performance outcomes in the study.

Table 5: The Result of the Structural Model

Hypotheses	Beta	Se	T value	P Values	Decisions	Lower 2.5%	Upper 97.5%
RD-> Environmental	0.563	0.085	5.554	0.000	Supported	0.041	0.228
RD -> Social	0.552	0.092	5.870	0.000	Supported	0.122	0.407
RD -> Economic	0.218	0.100	1.777	0.076	Not Supported	0.194	0.553

Note: RD – Redesign Strategy

This research investigated the impact of redesign strategies on the sustainability performance of consumer goods manufacturers listed on the Nigerian Stock Exchange. The findings, particularly the significant relationships between redesign and environmental and social performance, highlight the importance of design in achieving sustainability goals.

The study tested three specific hypotheses. The first two (H1 and H2) predicted positive correlations. The results strongly supported these predictions. The analysis revealed a statistically significant positive relationship between redesign strategies and environmental performance ($T = 5.55$; $p < 0.01$). This aligns with existing theories suggesting redesign can lead to features like reduced resource consumption or cleaner production processes. Similarly, a strong positive connection emerged between redesign and social performance ($T = 5.87$; $p < 0.01$). This suggests that redesigned products or processes might benefit communities or improve working conditions for employees.

The issue becomes more nuanced when examining the economic impact. The study aimed to identify a positive relationship between redesign and economic performance (H3). However, the results did not yield a statistically significant connection ($T = 1.78$; $p = 0.076$). While existing research suggests that sustainable practices can ultimately translate into economic benefits, this study doesn't show a clear short-term economic advantage for redesign initiatives. This finding, with its borderline p-value ($p = 0.076$), warrants further investigation. Future research could explore why economic benefits might not be immediately apparent and delve deeper into the potential long-term economic advantages of redesign strategies for Nigerian consumer goods manufacturers.

Conclusion

The research highlights the significant positive impact of redesign strategies on the environmental and social performance of Nigerian consumer goods manufacturers. Statistically significant relationships support these findings and align with existing theories, demonstrating the effectiveness of redesign in achieving business sustainability.

However, the study presents a more nuanced picture regarding economic performance. While a positive relationship was hypothesized (H3), the results did not show economic advantage. This suggests that economic benefits of redesign strategies might not be readily apparent. Further research is needed to explore the reasons behind this and delve deeper into the potential long-term economic advantages for Nigerian consumer goods manufacturers. This investigation could shed light on factors influencing the economic impact of redesign initiatives, ultimately helping companies develop strategies that achieve a well-rounded sustainability performance encompassing environmental, social, and economic aspects.

These findings hold valuable implications for both policy and practice within the Nigerian consumer goods manufacturing sector. The government can incentivize redesign initiatives through grants, tax breaks, or public recognition programs specifically targeted towards sustainable design practices. Highlighting the environmental and social benefits documented in this study can encourage wider adoption of redesign strategy.

Manufacturers, on the other hand, should prioritize redesigning their products for sustainability. This can involve strategies like using recycled materials, creating products with extended lifespans, or

designing for easier disassembly and repair. While the immediate economic benefits might be unclear, companies can emphasize the long-term cost savings associated with resource efficiency and potentially explore innovative pricing models that capture the value proposition of sustainable products.

By promoting redesign strategies through policy and integrating them into business practices, Nigerian consumer goods manufacturers can achieve a more comprehensive approach to sustainability. This approach would encompass environmental and social responsibility alongside long-term economic viability. Further research on the long-term economic effects of redesign can provide even more robust guidance for future policy and practice decisions.

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