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Green Manufacturing Practices and Learning and Growth Efficiency of Consumer Goods Manufacturing Companies Listed in Nigeria

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Abstract: *The present paper investigates the impact of Green Manufacturing Practices (GMP) on the Learning and Growth (LGE) of consumer goods manufacturing companies listed in Nigeria. The study utilized Green Product Design (GPD), Green Supply Chain Management (GSM), Green Efficient Processes (GEP), Green Renewable Energy (GRE), and End-of-life Product Management (EPM) as constructs for green manufacturing practices on learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria. A survey research design was adopted for this study the consumer goods manufacturing companies listed in Nigeria made up the population of this study. The sample size of 228 was determined using Taro Yamane's formula and randomly selected. A 5-point Likert Scale questionnaire was employed for data collection. The validity of the instrument of data collected was premised on the vast experience of the managers and the reliability of the data was done using the Cronbach Alpha Coefficient Technique which produced between 0.767 and 0.966 results. Statistical Package for Social Sciences (SPSS) version 22.0 was used to analyze and test the multiple regression. Descriptive and inferential (multiple regression) statistics were used to analyze the data at a 5% significance level. The findings indicate that green manufacturing practices variables (GPD, GSM, GEP, GRE, and EPM) had a positive significant effect on learning and growth efficiency (Adj.R^2 = 0.440, F(6,217) = 35.001, $p < 0.05$) indicating that a unit increase in GMPs will enhance the LGE of consumer goods manufacturing companies listed in Nigeria. These findings should be of major interest to the Management of the consumer goods manufacturing companies listed in Nigeria. They suggest that*

they need to make informed strategic decisions about green initiatives and prioritize investments in them, while Government policymakers develop or refine regulatory frameworks that encourage green manufacturing practices in the manufacturing industry. This investigation provides original empirical evidence on the effect of green manufacturing practices on the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria.

Keywords – End-of-life Product Management (EPM), Green Efficient Processes (GEP), Green Product Design (GPD), Green Renewable Energy (GRE), Green Supply Chain Management (GSM), learning and growth efficiency (LGE).

INTRODUCTION

Learning and growth efficiency (LGE) involves the continuous development of an organization's employees and capabilities through initiatives like training, skill enhancement, and knowledge management to drive long-term growth and adaptability. LGE is concerned with employees' professional development, attachment to the entity spirit, and skills improvement opportunities (Tuan, 2020). Handling innovation in the manufacturing sector to bring about efficiency requires that only qualified personnel are employed and trained for such roles. Capacity building is an area that manufacturing firms in Nigeria need if they must achieve the needed efficiency. A manufacturing company that must thrive should have an internal environment that involves quality institutional policies on learning, good infrastructural, technological, and innovation development plans with human resources that are trained and retrained because the increase in knowledge and skills will enhance innovation and productivity (Adeyemo et al., 2020). For an entity to be able to achieve a determined level of output using a given minimum level of input and yet not compromising on quality is efficiency and it can be achieved through robust learning opportunities provided by the management which will lead to growth and ensure sustainability (Osazefua, 2019) and this capacity building seems to be lacking in the Nigerian consumer goods manufacturing sector.

This study's objective was to determine the effect of green manufacturing practices on the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria. The research question was: how do green manufacturing practices affect the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria? The study provides enrichment to the existing body of literature on the learning and growth efficiency of listed consumer goods manufacturing companies in Nigeria through empirical evidence relating to the discourse of green manufacturing practices in Nigeria.

Survey research design was employed for this study. The population of this study was 526 staff members at the managerial level of the consumer goods manufacturing firms listed in Nigeria. The sample size of 228 was determined using Taro Yamane's formula and randomly selected. A 5-point Likert Scale questionnaire was employed for data collection. The validity of the instrument of data

collected was premised on the vast experience of the managers and the reliability of the data was done using the Cronbach Alpha Coefficient Technique which produced between 0.767 to 0.966 results. Statistical Package for Social Sciences (SPSS) version 22.0 was used to analyze and test the multiple regression. Descriptive and inferential (multiple regression) statistics were used to analyze the data at a 5% significant level.

The study's main finding suggests that green manufacturing practices are important factors to be considered in achieving and sustaining the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria. This is evidenced by the result of the test, LGE ($Adj.R^2 = 0.440, F(6,217) = 35.001, p < 0.05$). The study concluded that green manufacturing practices produced a positive effect on the learning and growth efficiency of listed consumer goods manufacturing companies. The study recommended that investors should consider the long-term financial implications of green manufacturing practices in investment decisions, recognizing its potential to enhance learning and growth efficiency and build wealth for high returns.

The paper reviewed related literature in three folds, conceptual review, theoretical review, and empirical review. The primary data collected through the administration of a structured questionnaire were analyzed through descriptive analysis, and inferential analysis and interpretations given. Test of the formulated hypothesis was carried out using the collected data based on the specified multiple regression models. The main findings on the effect of green manufacturing practices on the customer efficiency of consumer goods manufacturing companies listed in Nigeria were also explained.

RELATED LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Learning and Growth Efficiency (LGE)

Learning and Growth Efficiency (LGE) is a pivotal concept in organizational management and development, that focuses on an organization's ability to effectively acquire, assimilate, and apply new knowledge and skills. LGE is seen as an important component of the Balanced Scorecard (BSC) that causally connects how workers improve upon themselves to provide better value to their employers which leads to effective processes, improved employee ability, and a degree of firm alignment that are critical in achieving the company's objectives (Sunday, 2023). LGE is described as an intangible asset that aims to better the performance of a firm and constitutes the basic perspective needed to support the other three perspectives through building an effective behavior, based on a firm’s capability to coordinate employee capability and abilities (Kaplan & Norton, 2007; Utomo et al., 2019).

LGE is quite important for successful change management leading to establishing a culture that encourages learning, unlearning, relearning, and adaptability which are central to achieving organizational goals. Organizational learning is the process of moving from unskillful knowing to skillful knowing, which may involve individuals, groups, or organizations, through competence,

individuals learn from their experience and apply it at work for good firm performance (Massingham et al., 2018). Concerning emotional intelligence, LGE emphasizes that self-awareness and self-regulation are important for individual and organizational development. The manufacturing sector, characterized by its dynamic nature, technological advancements, and ever-changing consumer preferences, demands a proactive approach to staying competitive. In this context, LGE as a concept emerges as a critical factor in ensuring a manufacturing company's success (Kane, 2019).

LGE is an organization's ability to acquire, assimilate, and apply new knowledge and skills (Rodriguez & Walters, 2017) swiftly and effectively. Its significance in manufacturing is multifaceted. First and foremost, it empowers companies to adapt to technological advances such as green manufacturing practices, a crucial aspect of maintaining a competitive edge in the industry (Stoyanova & Angelova, 2018). In a rapidly changing market landscape, the agility to respond to shifting consumer preferences and market demands is vital, and efficient learning and growth processes enable companies to do so (Teece, 2018). Moreover, a focus on learning and growth contributes to employee productivity and satisfaction by promoting continuous skill development (DeNisi & Murphy, 2017). Furthermore, companies that foster a culture of learning and growth are more likely to innovate and develop new products, positioning themselves as leaders in the market (Afuah, 2003). Thus, making learning and growth efficiency pivotal in ensuring the performance and sustainability of manufacturing companies in Nigeria and beyond.

Green Manufacturing Practices (GMP)

One of the new terms in the world of manufacturing that efficiently uses resources and ensures a friendly environment during the product life cycle is referred to as green Manufacturing practices (Haleem et al., 2023). GMPs are pollution prevention activities that involve reducing the use of energy, raw materials, solid waste, reusing products, and recycling water. Goyal et al., (2022) stated that the focus of GMP is not only limited to products but that it is an umbrella term that includes all the manufacturing processes and the entire system, and these include practices based on the principles that attempt to reduce, reuse, recycle, recover, redesign, and remanufacture. Firms in the production of goods are gravitating towards GMP adoption for some reasons such as to: benefit the environment leading to the benefit of the society at large, improve the firm’s brand image and reputation among consumers, and also attract customers that prefer firms that are environmentally responsible and all these will eventually lead to the improvement of the firm’s environmental, operational and economic performance (Bai & Sarkis, 2017; D'Angelo et al., 2022).

Green Product Design (GPD)

Eco-design is an important factor in sustainable development as it attempts to integrate some aspects of the environment into the design of products to reduce the harmful impact on the environment through the product’s life cycle product and process design can reduce waste,

mitigate air, land, and water pollution, and reduce health risks to human and other species (Buzuku & Kässi, 2019). Globalization and its processes to introduce innovation that expedites technology transmission and globalization-induced innovation appear to be more product-oriented than process-oriented (Skare & Riberio-Soriano, 2021). Green products are those that are naturally recyclable, reusable, and biodegradable. It is made with safe chemicals, repurposed materials, and natural substances (Moshood et al., 2022). Green products are produced and initially grown using permitted chemicals and they do not damage the environment or cause pollution. They are deemed to be environmentally benign as a result (Zhang et al., 2022). According to Raišiene et al., (2021), green product design uses innovative product design to address environmental challenges.

Green Supply Chain Management (GSCM)

Green Supply Chain Management (GSCM) also known as sustainable or Eco SCM tends towards efficiency and care for natural resources and thus contributes to improving innovation, waste reduction, profit generation, and building a strong competitive advantage thus linking GSCM to performance goals involving the implementation of environmentally and socially focused solutions to meet the needs of current and future generations leading to the achievement of social, moral, economic, legal, technical, and political attributes of performance (Zimon et al., 2020). GSCM is an important and critical strategy that can help firms achieve sustainable performance (Permana & Soediantono, 2022). GSCM as a concept is made up of three components which are green design, clean production, and recycling technology designed in such a way as to reduce resource and energy consumption as well as reduce the impact on the environment. GSCM was introduced first by Michigan University around 1996 to achieve a manufacturing supply chain theory (Tippayawong et al., 2016).

Green Efficient Processes (GEP)

Efficient processes not only meet but also surpass quality compliance norms. The recent rise of the inculcation of novel digital manufacturing technologies and precision equipment into these processes has opened new doors of innovation in the production and delivery processes (Guo et al., 2022). Manufacturing processes involve the transformations of products from raw material to finished goods while generating waste in the process in the forms of emission and product residuals such as sawdust, metallic burrs, and chips in machining operations which GM targets to reduce or eliminate such negative effects of manufacturing processes (Kumar et al., 2015). GM process cycle begins with the design, then the procurement, before manufacturing, which is closely followed by packaging and distribution, customer use to a product's end-of-life, and finally remanufacture. Green process requires systematic improvements to the entire operational and managerial processes to improve the efficiency of resources which is aimed at reducing the consumption of energy during the process of production making it good business sense for firms to invest in (Li et al., 2017 and Xie et al., 2019).

Green Renewable Energy (GRE)

Energy costs are on the rise because of the frequent crises in the energy sector being experienced throughout the world all over (Li & Zhang, 2018), which has led to the need to ensure a reduction in the consumption of fuel as well as that of the use of renewable energy. This, therefore, leads to the need for manufacturing firms to engage in GM by engaging in practices that use fewer natural resources and more renewable resources with little or no pollution (Zhang, 2018). One of the main matters affecting modern-day industrialization is the issue of energy utilization and recovery and the associated environmental pollution. Renewable energy is often referred to as "classical" Renewable Energy Sources (RES) which are generated from such sources as wind power, solar energy, and waterpower but in daily life, some products have the potential to be used as renewable energy are consumed within the manufacturing sector as long as there is a component with high energy potential and through the recycling process they could be used as a source of "renewable energy (Petronijevic et al., 2020). The motivation behind the switch to alternative sources of energy such as renewable energy is majorly the environmental crises all over the world such as the exhaustion of fossil fuels, global warming, and pollution-driven numerous health hazards (Rastogi et al., 2020).

End-of-life Product Management (EPM)

Environmental contamination due to solid waste mismanagement is a global issue. Developing countries such as Nigeria have few financial resources, waste management, and sustainable initiatives leading to open dumping and burning with little or no waste treatment implementation and proper final disposal systems (Ferronato & Torretta, 2019). End-of-life Product management (EPM) ensures that raw materials are replaced with less harmful alternatives that can be recycled and repurposed. By increasing use intensity and making more efficient use of resources, waste is reduced to a minimum and any minor amounts are recycled or utilized internally (Kehinde et al., 2020). There are no or poor green regulations in developing countries. Recycling by waste sorting and collection seems to be a regular thing to do by millennials in developed countries. On the other side in emerging countries, it is a privilege to have it (Freitas-Netto et al., 2020). The product's life cycle cost could considerably contribute to reducing the effects of environmental management practices and the consequences captured through the product's lifecycle (Ogunmola & Orajekwe, 2021). Manufacturing companies employ various strategies to enhance learning and growth efficiency to overcome challenges and promote continuous learning and development. The study, therefore, aims to examine the effect of GMP on manufacturing firms' efficiency using learning and growth efficiency.

The hypothesis tested in line with the objective of this study is:
H_{01}: Green manufacturing practices have no significant impact on the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria.

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METHODOLOGY

The study employed a survey design. Data was collected using a structured questionnaire. The population of this study was 526 managerial staff members of the consumer goods manufacturing firms listed on the Nigeria Exchange Group (NGX) as of 31st January 2024. The choice of consumer goods stemmed from their kind of products, production capacity, and their link to their companies, and it was also important to understand what was borrowed from international green technologies.

Copies of the questionnaire were distributed based on the sample size. To get the representative sample size, Taro Yamane sample size determination was employed. The formula is given as thus:

$n = \left(\frac{N}{1+N\,(e)^2}\right)$

n = the sample size; N = the population size; e = marginal error at 0.05

$n = \frac{526}{1+526(0.05)^2}$

$n = \frac{526}{2.315}$

n = 227.214≈ 228

Therefore, the total number of copies of the questionnaire distributed was two hundred and twenty-eight (228). The model that was used in testing the hypothesis of the study is presented below:

To evaluate Y = f (X)
Y = Dependent Variable (Learning and Growth Efficiency)
X = Independent Variable (Green Manufacturing Practices)
X and Y are broken down as follows
$Y = (y_1)$
$X = (x_1, x_2, x_3, x_4, x_5)$
Where;
y_1 = Learning and Growth Efficiency (LGE)
x_1 = Green Product Design and Development (GPD)
x_2 = Green Supply Chain Management (GSM)
x_3 = Green Efficient Processes (GEP)
x_4 = Green Renewable Energy (GRE)
x_5 = End-of-Life Product Management (EPM)
These will result to an expanded functional model of:
LGE = f (GPD, GSM, GEP, GRE, EPM) …….... Equation 1

The regression model is given thus as:
$LGE_i = \beta_0 + \beta_1 GPD_i + \beta_2 GSM_i + \beta_3 GEP_i + \beta_4 GRE_i + \beta_5 EPM_i + \mu$
Where:
β_0 is the intercepts and $\beta_1 - \beta_v$ represents the estimated parameters for tax administration.

β_1 = estimated parameter of Green Product Design
β_2 = estimated parameter of Green Supply Chain Management
β_3 = estimated parameter of Green Efficient Processes
β_4 = estimated parameter of Green Renewable Energy
β_5 = estimated parameter of End-of-Life Product Management
μ = error term or stochastic variable

DESCRIPTIVE AND EMPIRICAL RESULTS

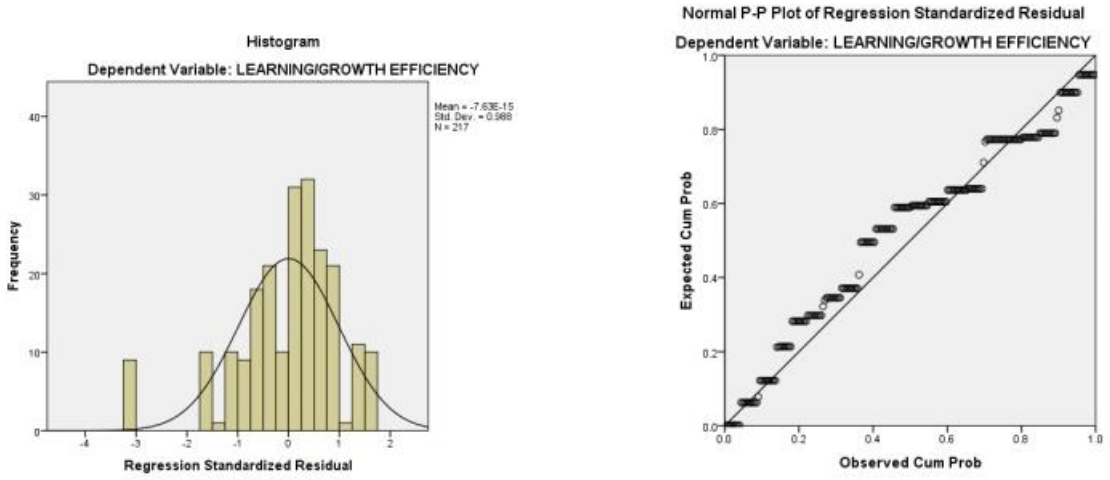
Data Treatment Results

This section showed the treatment results performed on the data gathered before the inferential analyses to ensure that the regression assumptions of normality, multicollinearity, linearity, and homogeneity of variance were met.

Results of Normality Test

To test for normality, the histogram was used to assess the normality of the model as shown in Figure 4.1 below.

Figure 4.1: **Results of Normality Test for Learning and Growth Efficiency**



Source: Researcher's Computation, 2024

In Figure 4.1, the histogram plot showed the normality test, which indicated that the residuals were normally distributed and had a goodness of fit as indicated by the bell-shaped diagram while the P-P plot revealed that the points were arranged along the diagonal line both having few outliers that will not negatively impact on the overall outcome. The Normal P-P plots showed linearity,

which implied that the predictor variable which is the Green Manufacturing Practices (Green Product Design, Green Supply Chain Management, Green Efficient Processes, Green Renewable Energy, and End-of-Life Product Management) had a straight-line relationship with Learning and Growth Efficiency.

Result of Multicollinearity Test

Table 4.2 Result of Multicollinearity Test

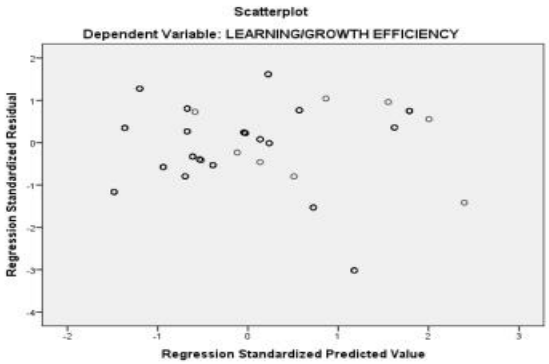
	Collinearity Statistics	
	Tolerance	VIF
Green Product Design	0.555	1.800
Green Supply Chain Management	0.648	1.544
Green Efficient Processes	0.559	1.790
Green Renewable Energy	0.527	1.898
End-Of-Life Product Management	0.421	2.375
Average	0.527	1.935
Dependent Variable: Operational Efficiency.		

Source: Author's Computation, 2024; data from Field Survey

Table 4.2 presented the results of the multicollinearity test, which revealed that the VIF values of all the independent sub-variables (Green Product Design, Green Supply Chain Management, Green Efficient Processes, Green Renewable Energy, and End-of-Life Product Management) were all between 1.544 to 2.375 producing an average of 1.935 which is less than 10 (VIF < 10). The Tolerance values ranged from 0.421 to 0.648 with an average of 0.527 which is higher than 0.1 (Tolerance > 0.1), suggesting that there was no case of severe multicollinearity problem in the variables of the study per the threshold given by (Gujarati et al., 2004; Shrestha, 2020).

Result of Homoscedasticity Test

Figure 4.3: Scatter plot for Homoscedasticity tests for Learning and Growth Efficiency



Source: Researcher's Computation, 2024

The scatterplot in Figure 4.3, learning and growth efficiency revealed no exact or systematic pattern, thereby signifying the normality of the residuals and the constant variance. This confirmed that the model was homoscedastic thus ensuring the reliability, validity, and robustness of regression analysis.

Test of Hypothesis

Restatement of Research Objective, Research Question, and Research Hypothesis, Analysis and Discussion

Research Objective: Determine the effect of green manufacturing practices on the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria.

Research Question: What is the effect of green manufacturing practices on the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria?

$H_0$1: Green manufacturing practices have no significant impact on the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria.

Table 4.2d: Summary of multiple regression between Green Manufacturing Practices and Learning and Growth Efficiency (Model 4)

N	Model	B	SE	t-stat	Sig.	ANOVA (Sig.)	R	Adjusted R^2	F (5,217)
217	(Constant)	1.965	0.192	10.209	0.000*	0.000b	0.673	0.440	35.001
	GPD	0.390	0.078	4.980	0.000*				
	GSM	-0.180	0.082	-2.179	0.030*				
	GEP	-0.149	0.080	-1.848	0.066				
	GRE	0.275	0.062	4.409	0.000*				
	EPM	0.214	0.079	2.713	0.007*				
		Predictors: (Constant), GPD, GSM, GEP, GRE, EPM							
		Dependent Variable: LGE							

Source: Researcher's computation, 2024 underlying data from Field Survey at 5% significant level.

Interpretation

Table 4.2d shows the multiple regression analysis results for the components of green manufacturing practices and the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria. The results show that Green Product Design (GPD) (β = 0.390, t = 4.980, $p < 0.05$), Green Renewable Energy (GRE) (β = 0.275, t = 4.409, $p < 0.05$), and End-of-Life Product Management (EPM) (β = 0.214, t = 2.713, $p < 0.05$) had positive and significant effect on learning and growth efficiency. On the other hand, Green Supply Chain Management (GSM) (β = -0.180, t = -2.179, $p < 0.05$) had a negative and significant effect on learning and growth efficiency. Green Efficient Processes (GEP) (β = -0.149, t = -1.848, $p > 0.05$) exerted a negative but insignificant effect on the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria. This implied that Green Product Design (GPD), Green Renewable Energy (GRE), and End-of-Life Product Management (EPM) were important factors in enhancing the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria.

The R-value of 67.3% supported this finding, indicating a strong positive relationship between green manufacturing practices and the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria. The coefficient of multiple determination $Adj.R^2$ = 0.440 indicated that only 44% of the variation occurring in the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria could be accounted for by the components of green manufacturing practices. The remaining 56% of changes occurring were accounted for by other variables not captured in the model. The predictive and prescriptive multiple regression models were thus expressed:

LGE = 1.965 + 0.390GPD - 0.180GSM - 0.149GEP + 0.275GRE + 0.214EPM--------Eqn(i) (Predictive Model)

LGE = 1.965 + 0.390GPD + 0.275GRE + 0.214EPM----------Eqn(i) (Prescriptive Model)

Where:

LGE = Learning and Growth Efficiency

GPD = Green Product Design

GSM = Green Supply Chain Management

GEP = Green Efficient Processes

GRE = Green Renewable Energy

EPM = End-of-Life Product Management

The regression model showed that when holding green manufacturing practices components constant at zero, learning and growth efficiency was positive at 1.965. Green Efficient Processes (GEP) were insignificant while green supply chain management (GSM) was in the predictive model, implying that management could downplay that variable. The results of the multiple regression analysis in the prescriptive model indicated that if Green Product Design (GPD), Green Renewable Energy (GRE), and Green Efficient Processes (GEP) are improved by one percentage, there will be an improvement in the learning and growth efficiency. Improvement in Green Supply Chain Management (GSM) may reduce the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria.

Also, the F-statistics (df = 5, 211) = 35.001 at p = 0.000 ($p < 0.05$) indicated that the overall model was significant in predicting the effect of green manufacturing practices and learning and growth efficiency. This further suggests that Green Manufacturing practices components (Green Product Design (GPD), Green Renewable Energy (GRE), and End-of-life Product Management (EPM) are important determinants of learning and growth efficiency. The result suggests that consumer goods manufacturing companies listed in Nigeria should pay more attention to developing Green Product Design (GPD), Green Renewable Energy (GRE), and End-of-life Product Management (EPM) components to maximize learning and growth efficiency. Therefore, the null hypothesis ($H_0$1) that green manufacturing practices have no significant impact on the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria is rejected. The alternate hypothesis stating that green manufacturing practices significantly affect the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria was accepted.

DISCUSSION OF FINDINGS

The findings from the Model in Table 4.2d provided an in-depth analysis of how various green manufacturing practices affect the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria. The finding implies that green manufacturing practices affect the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria. The findings of this study align with the work of other scholars as follows: Khaleeli et al., (2021); Li et al., (2017); Tuan, (2020), and Xie et al., (2019) provided findings revealing that GMPs positively and significantly affect learning and growth efficiency and noted that green product design, green renewable energy, and end-of-life product management stood out significantly to have a positive effect on learning and growth efficiency.

Implications of Findings

The findings of this study have various implications for various stakeholders within the consumer goods manufacturing industry and the entire manufacturing sector as follows:

The Management of Manufacturing Companies: These findings imply that the management of consumer goods manufacturing companies can use them to guide strategic decisions on sustainable

initiatives and prioritize investments in green product design (GPD), efficient processes (GEP), and renewable energy adoption (GRE) to enhance learning and growth efficiency.

Investors: Investors may factor in the findings of this study when assessing investment opportunities in the manufacturing sector knowing that companies with strong commitments to green manufacturing practices and environmental sustainability may be perceived as less risky and more attractive investment options.

Policy Makers: Policymakers can use the findings to develop or refine regulatory frameworks that encourage green manufacturing practices in the manufacturing industry. They could also introduce support mechanisms such as tax incentives, subsidies, or grants to encourage companies to adopt sustainable technologies and practices.

Academics: Academicians and researchers could use the results could form curriculum development and educational initiatives related to sustainability, operations management, and strategic decision-making to equip future manufacturing professionals with the necessary knowledge and skills.

Other Stakeholders: Consumers may become more aware of the importance of sustainability practices in the manufacturing industry and may choose to support companies that demonstrate commitment to green manufacturing practices.

Recommendations

Based on the findings and conclusion of this study on the effect of green manufacturing on learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria, the following recommendations are made:

1. The decision makers and the management team of consumer goods manufacturing companies listed in Nigeria should prioritize the adoption of green manufacturing practices such as green product design, green renewable energy, and end-of-life product management in their manufacturing processes to help enhance the learning and growth efficiency of their firms and enjoy competitive advantage.
2. Policymakers should develop and enforce policies and regulations that incentivize and mandate sustainable practices in the manufacturing industry, promoting innovation and responsible production will help achieve learning and growth efficiency.
3. Regulators should strengthen regulatory oversight and enforcement mechanisms to ensure compliance with environmental and sustainability regulations, holding manufacturing companies accountable for their impact on the environment and ensuring the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria.

Contribution to Knowledge

This study made some contributions to the existing body of knowledge within the manufacturing sector in Nigeria in the following ways:

Policy – The study's findings hold substantial implications for government entities engaged in policy formulation. By establishing a robust connection between green manufacturing practices and the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria, the research offers a roadmap for policymakers to design effective regulations and measures that will optimize the use of sustainability practices within the manufacturing sector for learning and growth efficiency and sustainable performance.

Theory: The study found that manufacturing entities engaging in green manufacturing practices judiciously utilize available resources, enhancing learning and growth efficiency and positively contributing to the environment, benefiting all stakeholders. This supports the continued relevance of both Ecological Modernization Theory (EMT) and Stakeholder Theory.

Concepts: The objective of this study furnished empirical substantiation regarding the effect of green manufacturing practices on the learning and growth efficiency of consumer goods manufacturing firms listed in Nigeria. The study contributed that a combination of some green manufacturing practices - green product design, green efficient processes, and green renewable energy will enhance the learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria.

Literature: The study's conceptual work contributed to the frontiers of knowledge on the effect of green manufacturing practices on learning and growth efficiency of consumer goods manufacturing companies listed in Nigeria, and this involved the consideration of one of the four proxies of balanced scorecard in assessing learning and growth efficiency while five proxies of green manufacturing practices (Green Product Design, Green Supply chain Management, Green Efficient Processes, Green Renewable Energy, End-of-life Product Management). The study contributed unique data for the various variables undertaken in this study for future use by both scholars and industry practitioners.

Academics: For the academic world, the research contributed through the prescriptive model produced which showed the effect of each green manufacturing practice on the various proxies of learning and growth efficiency of consumer goods manufacturing firms listed in Nigeria.

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