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Green Process Innovation and Sustainable Performance of Listed Bottled Water Companies in Nigeria

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Abstract: *This study has been undertaken to investigate the effect of green process innovation on sustainable performance of Bottled Water Companies in Nigeria. Specifically, the study examined the effect of energy efficient process, sustainable water management system and environmental training awareness on sustainable performance. The study is anchored on Innovation Theory. This study utilized the survey research design; the study area is Listed Bottled Water Company's in Nigeria. The population of the study was 321 staff of these companies which also serve as the sample size. The study made use of questionnaire with a validity and reliability index of .802. The study established that there are no significant positive relationships between the dimensions of green process innovation and sustainable performance of Bottled Water Companies in Nigeria. It is recommended that Managers/owners of bottled water companies in Nigeria should integrate energy efficient process so as to harness the benefits for sustainable performance. The use of solar energy for instance will reduce the reliance on the power sector and solve the problem of incessant power outages and national grid collapse. Bottled water manufacturing companies in Nigeria should implement sustainable water management processes in their business operations since it highlights ability of companies to enhance other sources of water supply such as rainfall harvesting. This will help them preserve water during the rainy season and use it throughout the year for effective bottled water production and achieve sustainable performance. Managers /owners of bottled water companies in Nigeria should constantly carry out environmental training awareness for their staff to remind them of the importance of proper waste disposal. This can be done if the government and other regulating institutions should come up with policies that encourage reducing the negative impact associated with careless disposal of plastic bottles and sachet water to protect the environment.*

Keywords*: Green Process, Innovation, Sustainable Performance.*

1.0 INTRODUCTION

1.1 Background to the Study

Increasing environmental degradation has challenged the world's major industries as they face severe environmental consequences. The ecological decline becoming a global phenomenon has made stakeholders respond to the increasing climatic vulnerability through a sustainable model. In recent years, natural environment protection has received attention internationally. Given the application of environmental measures, regulations have forced firms to protect the natural environment by adopting sustainable innovation (Naseem *et al*., 2021). Developing countries are not left out in the process of looking for measures to avert environmental impact so as to achieve sustainable performance.

This strengthening urge for sustainable performance has emphasised using green processes to minimise the increasing effect of environmental vulnerabilities (Yousaf, 2021). However, today, the protection of the natural environment is not only possible with innovative processes but also with energy efficient process. Energy efficient process entails using renewable energy sources such as solar, wind and hydropower during production process. This will reduce cost as well as achieve sustainable performance and development. Saudi *et al*. (2019) states that increasing role of energy efficient process has made organisations reduce cost of products and services, influencing their sustainable performance. Sustainable water management system such as rain water harvesting, waste water treatment can also reduce water consumption and promote water conservation. Another critical factors necessary for sustainable performance and development is environmental awareness. Environmental awareness refers to the level of consciousness and concern that individuals, organizations, and societies have about the state of the natural environment and the impact of human activities on it (Earth Reminder, 2022). It involves an understanding of environmental issues and a willingness to act to protect and preserve the environment such as proper disposal of waste.

Sustainable Performance is the harmonization of environmental and financial objectives in the delivery of core business activities to maximize value. According to the Organization for Economic Cooperation and Development (OECD, 2006) Sustainable performance is measured in several ways: social performance, economic performance and environmental performance, this definition is adopted for this study. The focus of this study is the Bottled water companies in Nigeria which aimed at providing finest quality processed Table Water, Natural Juice and fruit Drinks around Nigeria and its neighbouring countries. The motivation behind this research is that the outcome will assist the government and industry players to fine-tune the state policies and managerial decisions for better environmental responsibility. This paper reviewed current literatures from a more conventional green process innovation perspective and contributes a set of findings that capture the current state-of-the-art of this topic.

1.2 Statement of the Problem

Over the years, progressing industrialisation has forced humans to face the severe effect of environmental degradation, which is weakening the world's socio-economic prosperity.

The building ecological burden has caused the earth's biodiversity to experience unprecedented consequences. In particular, today, the dual environmental impact on social and commercial lives has elevated the need to find the solution to the developing socio-ecological problems. Bottled water companies in Nigeria play a vital rule in the provision of clean and portable water to the populace. Their activities if not properly checked can impact negatively on the environment. Undoubtedly, there is a lack of sufficient researcher attention in the area of green process innovation with regard to sustainable performance. In particular, the previous literature has shown that employees' poor understanding of green-sustainable behaviour has made some firms bear unprecedented environmental consequences, which potentially needs further investigation (Riaz et al., 2019). This calls for an urgent investigation to investigate the level of bottled water companies' awareness of green process innovation and its impact on sustainable performance.

1.3 Objectives of the Study

The main objective of the study is to review the effect of green process innovation on sustainable performance of bottled water companies in Nigeria. The specific objectives are to;

i. determine the effect of energy efficient process on sustainable performance of bottled water companies in Nigeria;
ii. examine the effect of green water management system on sustainable performance of bottled water companies in Nigeria;
iii. investigate the effect of environmental awareness on sustainable performance of bottled water companies in Nigeria.

1.4 Significance of the Study

The outcome of this study is expected to be useful to the future scholars, researchers and other bodies that will want to get information or research on green process innovation. They will be able to get the insights surrounding the green process innovation concept, the theories and models surrounding the concept both locally and internationally. The study is of immense assistance to policy makers in developing economies to set environmental standards to attract investors. The findings shall provide policy implications for government in supporting green process innovation. It also provides information to the government policy maker to encourage bottled water companies to adopt green process innovation through the use of energy efficient process, green water management system and environmental awareness. Finally, the research shall provide data that will assist bottled water companies with implementation and management of green process innovation.

2.0 LITERATURE REVIEW

This section discusses theoretical framework, conceptual framework and review of related studies.

2.1 Theoretical Framework

This paper is anchored on innovation theory

The theory of innovation was propounded by Joseph A. Schumpeter in 1934. Alternatively, it is referred to as Schumpeter's theory of innovation. According to

Schumpeter, the process of innovation by competing firms interacting in the marketplace results in "creative destruction". By definition, creative destruction is the portable opportunity seized by innovators that benefit not only them but the entire society. It assumes that an entrepreneur has three major characteristics: innovation, foresight, and creativity. Entrepreneurs engage in creative destruction when they disrupt existing goals and modify the direction of the economy by destroying the existing equilibrium in the market. In order to achieve this, they had to create new markets, introduce new manufacturing methods, discover new markets for products, find new raw material sources, and establish new manufacturing technologies. Successive scholars and researchers have carried forward Schumpeterian notions of innovation. Drucker and Maciariello (2014) believed that entrepreneurs always seek change, respond to it, and turn it into opportunities for innovation. In addition, Covin and Wales (2012) find that innovation is one of the key factors that stimulate business growth in SMEs. The Schumpeterian theory assumes that firms progress through innovations they carry out for profit-seeking reasons. In other words, every innovation is aimed at creating some new process, product, or market that gives its creator some competitive advantage over its competitors by making old ones obsolete (Muthee-Mwangi and Ngugi, 2014). As a result, innovation contributes to SMEs' sustainability and superior performance by providing a comprehensive, vibrant, and complementary foundation for SMEs' growth (Afriyie and Musah, 2019). As a result, this theory is relevant to the current study, as it enables a deeper understanding of innovation as they relate to the performance of SMEs. The diffusion theory of innovation and the resource-based view theory of innovation support this theory. Accordingly, SMEs must be innovative to survive and grow (Ibidumi *et al*, 2014).

2.2 Conceptual Framework

2.2.1 Green Process Innovation

Asadi *et al*., (2020) defined green process as the specific actions that allow reducing the environmental impacts among all the processes involved in the manufacture activities of a product. Green process innovation guides firms' social and environmental performance. It reduces the negative impact of a changing climate such as reduce waste, pollution and energy consumption while ensuring an efficient use of natural resources. Indeed, green process innovation is an integral tool, eradicating the degradation of the natural environment. For example, Hernandez-Vivanco et al. (2018) state that green process innovation radically improves organisational operations, thus contributing to firms' long-term sustainability.

2.2.2 Measures of Green Process Innovation

Congbin et al. (2023) identified the measures of Green Process Innovation to include: energy efficient process, green water management system and environmental awareness and the same have been adopted for this study and are hereby explained below;

i. Energy Efficient Process: This means the process of using renewable energy sources such as solar, wind and hydropower (Awam, 2021). Businesses frequently employ green process innovations to increase production efficiency, reduce costs, and expand market opportunities. With the use of such technologies, during production, waste is significantly reduced or recycled, and energy is used more effectively.

ii. Green Water Management System: This is the process of using other sources of water in a way to minimize or reduce water consumption. This include the alternative use of water such as rain water harvesting, waste water treatment which can reduce water consumption and promote water conservation (Lim *et al*., 2023). Study shows that these ecological prevention concerns have inspired employees to take necessary action, thus promoting sustainable environmental performance (Song & Yu, 2018)

iii. Environmental Awareness

Environmental awareness plays a critical role in green process innovation as it is more oriented towards the environment and the challenges it is facing. These challenges can only be incorporated into green process innovation and also eliminated completely. These problems include the method of waste dispersal, control of land and water pollution through proper means that ensures the protection of the environment as well as method of recycling (Congbin, et al., 2023). Overall, the literature indicates that environmental awareness has upgraded firms' sustainable performance via green process innovation. The green process innovation approaches provide a win-win solution to organisations, thus assisting them to achieve sustainable performance.

2.2.2 Concept of Sustainable Performance: Sustainability refers to the usage of global resources in a way that considers the benefits to future generations. It is the ability of the organization to achieve sustainable business objectives and increase value for shareholders, taking into account the long-term economic, environmental and social responsibility.

2.2.2 Measures of Sustainable Performance

Current sustainability research trends focus on social, economic, and environmental sustainability (Kristensen, et al., 2020). **Social performance:** It is one of the most important aspects of sustainability, as it refers to people's mentality and ways of thinking. In addition to objectives, standards of living and equity, social dialogue, delegation of responsibilities and protection of culture/heritage. **Economic performance:** This means sustainability in growth and development and the stability of financial performance (Hensher, 2023). **Environmental performance:** Continuing to conserve and protect natural resources and avoid pollution for those resources (OECD, 2006). This study adopts economic sustainability as the measure of sustainable performance.

2.2.3 Overview of Bottled Water Companies

Bottled water production in the world began as a medical product in the first stage. Due to the water bottled from sources, it is thought to be the healing power for treatment purposes. Bottled water was found in the spa centres until the middle of the 19th century and was consumed only by the elite. It is quite new for the public to consume it (Foote, 2011). The bottled water sector, pioneered by Europeans, is now in a rapid development process and its consumption tendency is increasing. The first bottled mineral water for public consumption in the USA was in the second half of the 18th century (Hawkins et al. 2015, Pandal 2020). At present, the global market for all non-alcoholic packaged beverages generates revenues of over $1,225 billion. Bottled water makes 17–24% of

this number depending on how “beverage market” and “bottled water” are defined (Ross 2021). With such significant “weight”, the bottled water sector can play a major role in global sustainable development processes, particularly considering how critical water is to humans.
In Nigeria, bottled water is produced and consumed in large quantity daily. The report/ information on plastic pollution associated with bottled water, pointing out that the world currently generates around 600 billion plastic bottles amounting to approximately 25 million tonnes of plastic waste, which is not recycled but is disposed of in landfills or as unregulated waste. While there are signs of growing social awareness of the adverse impacts of plastics on the environment, a breakthrough solution that could radically reduce the environmental impacts of plastics does not yet appear to exist. Hence plastic pollution will likely continue in the years to come (Suntos et al., 2016). This calls for a study into the analysis of green process innovation and its impact on sustainable performance of bottled water companies in Nigeria.

2.3 Review of Related Empirical Studies
Wu Q, et al., (2024) examined the effects of environmental awareness training and environmental commitment on firm’s green innovation performance in China. The study adopted the survey research design and used the primary source of data collection utilizing a well-structured questionnaire. The study population were 285 medical equipment manufacturing companies. Data collected were presented using descriptive statistics such as tables and percentages while the test of stated hypothesis was done using regression analysis with SPSS. The result showed that there is positive significant relationship between environmental training awareness and firms green innovation performance.

Sihemeje et al. (2020) evaluated the effect of green production practices on the continued survival of agro-allied businesses in Nigeria. This study was carried on 306 owners and managers of Agro-Allied small businesses within the study area. The primary source of data was collected using questionnaire and were statistically analysed. A null hypothesis was formulated that was tested using the Z-test statistical tool and the SPSS package. The findings revealed that green agricultural production would significantly affect the continued survival of agro-allied businesses in Nigeria. The study concluded that despite notable changes in legislation and regulations to protect the environment, Nigeria and various other countries are constrained with unprecedented environmental problems arising from climate change and established that environmental problems can only be solved through technological advancement by the input of ecopreneurship.

Haseeb et al. (2019) investigated the effect of renewable energy on the economic growth of Malaysia over the time 1980-2016 using secondary data. The study employed the autoregressive distributed lag (ARDL) bound testing approach. The SPSS was used to test the stated hypotheses. The outcome is that there is a positive and significant effect of the use of renewable energy source on economic growth of Malaysia. Similar results are found by Rafindadi and Ozturk (2017) and Khobai and Le Roux (2017) for Germany and South Africa, respectively, using the ARDL approach. Bhattacharya et al. (2016) using the fully modified ordinary least square (FMOLS) highlighted the positive and

significant influence of renewable energy utilization on economic performance in the top 38 renewable energy consumer countries.

Zamfir, Mocanu and Grigorescu (2017) studied the effect of water re-use on firms financial performance using European firms located in the United Kingdom, Hungary and Slovakia. The study adopted the descriptive research design and utilized the primary source of data with a well-structured questionnaire. The data collected were analysed using descriptive statistics and inferential statistics (regression analysis) was also used to test the stated hypotheses. The study finding was that minimising water usage while concurrently maximising re-usage has positive effect the firm's financial performance and that it is clear that water sustainability unlocks momentous financial benefits to firms. Zokaei, (2013) believes that water efficiency can assist firms to cut cost in terms of reducing water bills which capacitates the firm to make profits.

Yuan, (2017) investigated the effect of green process innovation on innovative benefit: The mediating effect of firm image in China. The study adopted the survey research design and the population comprised 267 staff of coal mining firms in China. Data were collected using a well-structured questionnaire and analysed using tables and percentages. Multiple regression analysis was used for the test of stated hypothesis and outcome was that green process innovation is involved in energy-saving, pollution-prevention, and waste recycling which can be used to improve the firm's environmental performance. Hence it was concluded that green process innovation has significant positive effect on firm performance.

3.0 METHODOLOGY

This study utilized the survey research design, the study area is Nigeria, comprising of listed bottled water companies. The population of the study was 321 with a sample size of 321 comprising of the total population reason being that the number can be controlled by the researcher. The study made use of questionnaire with a validity and reliability index of .702. The model employed for this study is multiple regression analysis model which involves the independent variable (green process innovation), and the dependent variable (sustainable performance). Therefore the following model specifications to test the formulated hypotheses were formulated as follows:

SPF = (GPI) = (EEP, SWS, ETA)

Where

SPF = Sustainable Performance

GPI = Green Process Innovation

EEP = Energy Efficient Process

SWS = Sustainable Water Management System

ETA = Environmental Training Awareness

The regression model, thus is given as

$SPF = \beta 0 + \beta 1\ EEP + \beta 2\ SWS + \beta 3\ ETA + e$ …… (1)

Where

β0 = Intercept of the regression

β1- β3= parameter estimates

e = error term

Descriptive and inferential statistics were used to analyze data evaluating the effect among the variables. Inferential statistics that was used is regression analysis, to analyze data in order to determine the effect of green process innovation on the sustainable performance of bottled water manufacturing companies in Nigeria. The hypotheses formulated for this study were tested using p-value and student t-statistics generated from the regression model. The level of significance for the study is 5%, for a two-tailed test. The decision rule was that we reject the null hypothesis if the calculated t-value is less than the critical/t-value (±1.96), otherwise, we accept the null hypothesis, and using the p-value, we reject the null hypothesis if $p<0.05$ under 95% (or 5%) confidence levels.

4.0 RESULTS AND DISCUSSION

In this section, the discussion composed of data analysis, test of hypotheses and discussion of findings based on the objectives of the study, the corresponding research questions and hypotheses that guided the study.

4.1 Data Presentation

A total of 321 questionnaire items were distributed to respondents in the listed bottled water company across Nigeria comprising of either the managers/owners or supervisors of these companies chosen for this study, out of which three hundred and nine (309) were successfully filled and returned in analyzable form, recording a 96.3 % response rate.

4.1.1 Descriptive Statistics Analysis

The result in Table 1 shows predictors of the dependent and independent variables. The mean and standard deviation show the level of agreement of the respondents with the questions. For energy efficient process it has the mean and standard deviation values as (M=2.04, SD=0.120); sustainable water management system has mean value of 2.11 and standard deviation =0.152; environmental training awareness (M=2.09, SD=0.413) and performance (M=2.34, SD=0.388) indicating that bottled water companies in Nigeria does not practice green process innovation, thus it has no effect on their sustainable performance.

Table 1: Descriptive Statistics Analysis

Variable	Mean	Standard Deviation
Energy Efficient Process	2.04	0.120
Sustainable Water Management System	2.11	0.152
Environmental Training Awareness	2.09	0.413
Sustainable Performance	2.34	0.338

Source: Authors' Computation from SPSS Output, 2024

4.1.2 Regression Analysis

The hypotheses stated in this study were tested using regression model on the effect of green process innovation on sustainable performance of listed Bottled Water Companies in Nigeria. The result of the model summary in Table 2 explains the relationship between

the dependent and the independent variables. The R^2-value shows the extent of the relationship between the variable which is a strong relationship going by the value of 0.578. The adjusted R^2 value of 0.570 indicates the variation between the variables entailing that 57% of Bottled water sustainable performance was explained by predictor variables which include energy efficient process, sustainable water management system and environmental training awareness. The remaining 43% is explained by other factors not included in the model.

Table 2: Model Summary

Model	R	R Square	Adj. R Square	Std. Error of Estimate	Durbin Watson
1	760a	.578	.570	.451	1.832

a: Predictors (constant), environmental training awareness, sustainable water management system, energy efficient process
b. Dependent variable: Sustainable Performance
Source: SPSS regression output version 26.0, 2024.

The result of the Analysis of Variance (ANOVA) in Table 3 describes the effect of the independent variables on the dependent variable. The F value was less than 1.98 and the significance level is more than 0.05 (F=1.306; Sig=0.103). This is an indication that the independent variables jointly has no significant effect on the dependent variable.

Table 3: ANOVAb for the overall significance of the model

Model	Sum of squares	Df	Mean square	F	Sig
Regression	255.460	4	63.865	1.306	.103[b]
Residual	190.867	305	0.5946		
Total	446.327	309			

a: Predictors (constant), environmental training awareness, sustainable water management system, energy efficient process
b. Dependent variable: Sustainable Performance
Source: SPSS regression output version 26.0, 2024.

Table 4 presents the result of regression coefficient, hence taking all other independent variables at zero, a unit change in energy efficient process would lead to a 20.0% increase in sustainable performance of bottled water companies; a unit increase in sustainable water management system would lead to 45.8 % change in sustainable performance of bottled water companies while a unit change in environmental training awareness affects bottled water companies' sustainable performance by 17.2%. The result implies that green process innovation has effect on sustainable performance of bottled water companies in Nigeria.

Table 4: Regression Coefficient Result

Model	Beta	T	Sig
1 (Constant)	1.099	1.181	.000
Energy Efficient Process	.200	1.377	.201
Sustainable Water Mgt Process	.458	1.159	.130
Environmental Training Awareness	.172	1.489	.072

Dependent variable: Sustainable Performance
Source: SPSS regression output version 26.0, 2024.

4.2 Test of Hypotheses and Discussion of Findings

The test of hypothesis one states that energy efficient process has no significant effect on the sustainable performance of bottled water companies in Nigeria. Regression analysis was used in testing the hypothesis at 0.05 level of significance and the p-value was greater than 0.05 (p=.201>0.05), hence the null hypothesis was accepted and we conclude that energy efficient process has no significant effect on the sustainable performance of bottled water companies in Nigeria. The finding of this study is not in agreement with that of Haseeb et al. (2019) who found a positive and significant effect. This shows that bottled water companies in Nigeria does not harness the advantage of energy efficient process such as using renewable energy sources e.g. solar energy.

The result of the second hypothesis indicates that sustainable water management system has no significant effect the sustainable performance of bottled water companies in Nigeria (p=.130>0.05), hence the null hypothesis was accepted and we conclude that sustainable water management system has no significant effect on the sustainable performance of bottled water companies in Nigeria. The findings of this study is also not in tandem with that of Zamfir, Mocanu and Grigorescu (2017) who studied the effect of water re-use on firms financial performance using European firms located in the United Kingdom, Hungary and Slovakia. The finding was that minimising water usage while concurrently maximising re-usage has positive effect the firm's financial performance and that it is clear that water sustainability unlocks momentous financial benefits to firms. It is clear that Nigeria firms do not harness the advantage of using sustainable water management system. This was emphasized by Tseole et al., (2022) that there is still poor knowledge and practice in the management of water use and other societal factors such as poverty which act as a barrier to proper management of water usage. This is because climate change increases these difficulties through changes in rainfall patterns, which causes more flooding and prolonged drought thus deepening the roles of the pyramid of water management challenges facing Nigeria. Coping with such issues involves a combination of social support, enhanced and appropriate policies, and finances put into structures organised to provide water for the whole country.

Hypothesis three test whether there is a significant effect of environmental training awareness on sustainable performance of bottled water companies in Nigeria and the result was that 05 (p=.072>0.05), hence the null hypothesis was accepted. This implies that environmental training awareness has no significant effect on the sustainable performance of bottled water companies in Nigeria. The findings are not in line with those of other authors who conducted similar studies in other countries. For instance the study

of Wu Q, et al., (2024) whose study found that there is positive significant relationship between environmental training awareness and firms green innovation performance of 285 medical equipment manufacturing companies in China.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Based on the findings of this study, it is concluded that the use of energy efficient process, sustainable water management process and environmental scanning has significant effect on the sustainable performance of bottled water manufacturing companies in Nigeria.

5.2 Recommendations

i. Managers/owners of bottled water manufacturing companies in Nigeria should integrate energy efficient process so as to harness the benefits for sustainable performance. The use of solar energy for instance will reduce the reliance on the power sector and solve the problem of incessant power outages and national grid collapse.

ii. Bottled water manufacturing companies in Nigeria should implement sustainable water management processes in the operations of their business since it highlights ability of companies to enhance other sources of water supply such as rainfall harvesting. This will help them preserve water during the rainy season and use it throughout the year for effective bottled water production and achieve sustainable performance.

iii. Managers /owners of bottled water manufacturing companies in Nigeria should constantly carry out environmental training awareness for their staff to remind them of the importance of proper waste disposal. This can be done if the government and other regulating institutions should come up with policies that encourage reducing the negative impact associated with careless disposal of plastic bottles and sachet water to protect the environment.

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