ECO-DESIGN CAPABILITY AND ENVIRONMENTAL PERFORMANCE OF FOOD AND BEVERAGES FIRMS IN PORT HARCOURT, NIGERIA

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Abstract

This study investigated the influence of eco-design capability on environmental performance of food and beverages firms in Port Harcourt. Eco-design capability was used as the explanatory variable which was treated as a single unit variable. Environmental performance was used as the explained variable, and was measured using emission reduction and resource conservation. The study adopted a survey research design. The population of the study consisted 19 food and beverages firms; and the entire population was surveyed. 4 copies of the research instrument was sent to each of the 19 food and beverage firms, with the target respondents being overseeing chief, acquiring supervisor, activities administrators and creation director. The simple regression analysis was used to test the hypotheses. The results showed that eco-design capability has significant positive influence on emission reduction and resource conservation. The study concludes that eco-design capability predicts environmental performance of food and beverages firms in Port Harcourt; and recommends that management of food and beverage firms should devote more effort on eco-design capability, if they seek to achieve higher levels of environmental performance.

Keywords: Eco-design capability, emission reduction, environmental performance, resource conservation

Introduction

Environmental performance is a topical issue globally; a major source of risk and uncertainty for businesses, and affects investment decisions, consumer behaviour and government policy. According to Peille et al. 2020), environmental performance is predicated on internal environmental interventions geared towards enhancing or making manufacturing processes more sustainable. This view is akin to that of Ren et al. (2019) that environmental performance reflects a firm's efforts to address environmental issues and focuses on managerial strategy and process, including environmental policies, objectives and management structures.

The issue of environmental performance has attracted interest not only from policymakers but also from scholars for over two decades (Horvathova, 2012; Dobber et al., 2014; Trump et al., 2017; Shahab, et al., 2018; Elmagrhi et al., 2019). These studies generally indicate that investments in environmental performance are related to superior economic performance. According to Habib and Bao (2019), in order for firms to sustain their competitive advantage and drive optimal efficiency in the 21st century economy, they must boost their capability to gain accurate and deep understanding of the market, customers and environmental realities; and also embrace technology and sustainability practices. Eco-design has emerged as a set of managerial practices that integrate environmental issues into the design phase; and which if implemented successfully, can confer competitive advantage while enhancing the environmental sustainability of the firm (Laari, 2016).

Eco-design capability is increasingly becoming an important resource that enhance international competitiveness and sustainability for manufacturing firms. Mainly, eco-design capability reduces environmental impact and operating costs; and makes it easier for firms to enter into new markets and launch new products. Therefore, eco-design capability can increase firms' competitiveness increasing financial performance (Knight & Jekins, 2009).

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The development of eco-design capability lead to reduced environmental footprints and waste, and results in the use of scarce natural resources more effectively and efficiently. There has been substantial research efforts to link eco-friendly business practices to different aspects of sustainability outcomes. Ademulegun et al. (2022) examined effect of eco-design capability on performance of Nigerian Bottling Company. Schafer, and Lower (2020) did a review of extant literature on eco-design capability. Swalche et al. (2020) examined effect of eco-design capability on performance of manufacturing firms in Kenya. Zong et al. (2018) studied eco-design capability and consumer behaviour.

The forgoing betrays a dearth of studies on the relationship between eco-design capability and environmental performance. Thus, this study is designed to fill the identified gap by examining the relationship between eco-design capability and environmental performance of food and beverage firms in Port Harcourt, Nigeria. Environmental performance was decomposed into emission reduction and resource conservation. The study was guided by the following hypotheses:

- Ho₁: Eco-design capability does not significantly influence emission reduction of food and beverage firms in Port Harcourt.
- Ho2: Eco-design capability does not significantly influence resource conservation of food and beverage firms in Port Harcourt.

Theoretical Foundation

This study is anchored on stakeholder theory (Freeman, 1984) which states that a stakeholder is a group or individual that can influence the achievement of an organization's goals. The activities of a company are influenced by internal and external actors known as stakeholders. The survival of a company heavily depends on stakeholder's support. The stronger the support is, the greater the company's effort to adapt with the stakeholders one of which is the sustainability of the company regarding the environment, reputation, and regulation.

Stakeholder theory describes parties both groups and individuals, who can influence or be influenced by the achievement of company goals (Saputra 2020). In adopting stakeholder theory, to eco-design capability, we recall that green practices emphasizes the importance of considering the interests and impacts on all stakeholders in decision-making processes, thus, we can safely state stakeholder theory is highly relevant to a study on eco-design capability.

Concept of Eco-design capability

Eco-design is a new concept in the field of environmental management that integrates economics, environment, management, ecology and other subject, and is deemed an effective manner to promote the circular economy development model. Eco-design is also called green design. Eco-design capability is defined as the integration of environmental aspects into product design, procurement, production, distribution and end of life management with the aim of minimizing environmental impacts throughout the supply chain (Directive 2009/125/EC, European Council 2009a).

The eco-design activities mainly include two aspects: to reduce resources consumption and realize the sustainable development strategy from the perspective of environmental protection, and to lower the cost and reduce liability and enhance competitiveness from a commercial perspective (Zong & Chen, 2017).

Over all, eco-design capability enables fosters environmental friendly practices in product design and development, and considers product's impact on the environment throughout its life cycle. The aim of eco-design is to create products that are more sustainable, reduce environmental harm, and contribute to circular economy - an economy focused on eliminating waste and continuous use of resources.

Concept of Environmental Performance

Nowadays many companies have become conscious of the need to run business in a sustainable way, hence devoting increasing efforts to achieve better environmental performance (Porter & Reinhardt, 2007). Environmental performance is a topical issue globally. For over two decades, the issue of environmental performance has attracted the interests of policy-makers and scholars alike (Shahab, et al., 2018; Elmagrhi et al., 2019) mostly because investments in environmental performance are related to superior economic performance.

Peille et al. (2020) states that environmental performance is informed by internal environmental interventions that promote sustainable manufacturing. Environmental performance reflects a firm's efforts to address environmental issues and focuses on managerial strategy and process, including environmental policies, objectives, and management structures (Ren et al., 2019).

Scholars canvass different indices of environmental performance (Symeou et al., 2019). Ardito and Dangelico (2018) suggested carbon productivity, energy productivity, water productivity, and waste productivity; while Marrucci et al. (2024) proposed resource conservation, human health and safety, and ecological remediation. In this study, we adopt emission reduction and resource conservation to measure environmental performance

Emission reduction

Emission reduction refers to the process of decreasing the release of pollutants, greenhouse gases, or harmful substances into the environment. It involves implementing measures to lower the number of emissions generated by human activities such as industrial processes, transportation, energy production agriculture, and waste management (Ibrahim, 2020). An analysis of existing literature shows that earlier studies assumed that investments in environmental protection provid little economic or financial benefits (Walley & Whitehead, 1994).

King and Lenox (2001) stated that the strategic position of a company leads to both lower pollution levels and improved financial performance. Wang et al. (2019) found a positive relationship between financial performance and emissions. Similarly, Waltho et al. (2019) and Elhedhli and Merrick (2012) try to build a network design to reduce carbon emissions.

Four policies are recommended by Waltho, et al. (2019) that successfully reduce emissions without increasing high costs, i.e., carbon offset, carbon cap, carbon tax, and cap-and-trade. Cap-and-trade is the most preferred policy because it has high flexibility. Du, et al. (2019) utilize a system dynamic method to investigate carbon reduction technology policies to the level of economic growth.

Resource conservation

Resources conservation is the rational use and proficient management of the natural environment and its resources (Wang et al. 2019). Resource conservation efforts identify factors affected by conflicts that arise between fulfilling needs and securing resources. It is consequently linked to the environment, sustainability, integrated landscape, natural resource, fisheries, forest, wildlife and

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others (Olalekan et al. 2019). A firm's resource conservation efforts contributes to the improvement and development of environmental performance (Henri 2008). Resource-conservation efforts encourage and improve mechanisms of environmental performance. A firm's environmental resourceconservation efforts are the most important contributor to the development and improvement of environmental performance.

Eco-Design Capability and Environmental Performance.

Scafer and Lower (2021) undertook an extensive literature review on eco-design capability, and observed that eco-design capability is effective in reaching environmental goals, resource efficient (time, money, physical resources), addressing the complete product life cycle, support decisionmaking under uncertainty and handling trade-offs; while Zong et al. (2018) revealed that eco-design capability enable enterprises reduce the use of resource, decrease energy consumption and pollutant and cut down greenhouse gas emissions. Also, Sanye-Mengual et al. (2014) found that maintenance behaviour and communication to-use strategies are crucial to eco-design capability of different household products and accounts for 40% to 80% of environmental improvement.

Methodology

This study focused on eco-design capability and environmental performance of food and beverage firms in Port Harcourt. The study adopted a survey research design. The population of the study consisted 19 food and beverage firms. The entire population was surveyed. 4 copies of the research instrument (a structured questionnaire) was sent to each of the 19 food and beverage firms. The target respondents in these firms were the overseeing chief, acquiring supervisor, activities administrators and creation director. The simple regression analysis was used to test the hypotheses, with reliance on the Statistical Package for the Social Sciences (SPSS) version 23.0. The decision rule that guided the study was:

Significant/probability value (Pv) < 0.05 (level of significance = conclude significant influence. Significant probability value (Pv) > 0.05 (level of significant = conclude insignificant influence

Result and Discussion

Model Summary							
					Std. Error of the		
	Model	R	R Square	Adjusted R Square	Estimate		
	1	.974ª	.949	.948	.680		

Table 1: Relationship between Eco-design capability and emission reduction

a. Predictors: (Constant), Eco-Design

Table 2: ANOVA^a of Eco-design Capability and Emission Reduction

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	639.773	1	639.773	1381.627	.000 ^b
	Residual	34.266	74	.463		
	Total	674.039	75			

a. Dependent Variable: Emission Reduction

b. Predictors: (Constant), Eco-Design

Source: SPPS Output 2024.

		Unstand	lardized	Standardized		
		Coeffi	cients	Coefficients		
Model		В	Std. Error	Beta	t	Sig.
1	(Constant)	.828	.329		2.519	.014
	Eco-Design	.931	.025	.974	37.170	.000

Table 3: Coefficients of Eco-design Capability and Emission Reduction

a. Dependent Variable: Emission Reduction

Source: SPPS Output 2024.

The statistics in Tables 1-3 shows that the .000 value is less than 0.05, there is a significant relationship between Eco-design capability and emission reduction. The regression shows an R (correlation coefficient) that is 82.8% directly related to 1 Eco-design capability and emission reduction. An R-square value of .949 indicates that Eco-design capability has 94.9% chance of influencing emission reduction an antecedent of environmental performance in the food and beverage firms. The ANOVA Table describes the safety of the model as indicated by.

The F ratio in the model is 21381.627, which is a significant value of p < 0.05. This means that there is significant evidence to demonstrate that eco-design capability influences emission reduction of food and beverage firms. This indicates that appropriate eco-design capability have implications for emission reduction as a facet of environmental performance. There is also a standard coefficient of .974 which is optimal with a similar P-value (sig.) of 000 which is less than alpha (0.05). We therefore infer that eco-design capability influences emission reduction of food and beverages firms in Port Harcourt

Table 4: Relationship Between Eco-Design Capability and Resource Conservation

	Model Summary									
	Std. Error Change Statistics									
Mod		R	Adjusted R	of the	R Square	F			Sig. F	
el	R	Square	Square	Estimate	Change	Change	df1	df2	Change	
1	.982ª	.964	.963	.542	.964	1956.99	1	74	.000	
						2				

a. Predictors: (Constant), Eco-Design Source: SPSS Output 2024.

Table 5: ANOVA of 1 Eco-design Capability and Resource Conservation

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	574.944	1	574.944	1956.992	.000 ^b
	Residual	21.740	74	.294		
	Total	596.684	75			

a. Dependent Variable: Resource Conservation

b. Predictors: (Constant), Eco-Design

Source: SPSS Output 2024.

				Standardized		
		Unstandardiz	ed Coefficients	Coefficients		
Model		В	Std. Error	Beta	t	Sig.
1	(Constant)	1.617	.262		6.174	.000
	Eco-Design	.882	.020	.982	44.238	.000
	Capability					

Table 6: Coefficients of Eco-design Capability and Resource Conservation

a. Dependent Variable: Resource Conservation

Source: SPSS Output 2024.

Tables 4-6 demonstrates that the .000 value is less than 0.05, there is a significant relationship between Eco-design capability and resource conservation. The regression shows an R (correlation coefficient) that is 98.2% directly related to eco-design capability and resource conservation An R-square value of .964indicates that Eco-design capability has 98.2% chance of influencing resource conservation an antecedent of environmental performance in the food and beverage firms. The ANOVA Table describes the safety of the model as indicated by. The F ratio in the model is 1956.99, which is a significant value of p <0.05. This means that there is significant evidence to demonstrate that Eco-design capability is related to resource conservation in food and beverage firms. This indicates that appropriate Eco-design capability strategies and procedures have a number of implications for resource conservation an antecedent of environmental performance. There is also a standard coefficient of .982which is optimal with a similar P-value (sig.) of 000 which is less than alpha (0.05). We therefore conclude that Eco-design capability relates with resource conservation in food and beverages firms in Port Harcourt.

The result from our analysis revealed that Eco-design capability has a significant and very strong relationship wit emission reduction with a beta value of .974. This position aligns with the report of Scafer and Lower (2021) who reported that eco-design capability is effective in reaching environmental goals, resource efficient (time, money, physical resources), address the complete product life cycle, support decision-making under uncertainty and the handling of trade-offs, and be available during the crucial early phases of the product development process.

The second analysis result revealed that Eco-design capability has a significant and very strong relationship wit resource conservation with a beta value of .982. This position aligns with the report Zong et al. (2018) who reported that Eco-design capability of consumer electronics is to promote enterprises to reduce the usage of resource, decrease energy consumption and pollutant and cut down greenhouse gas emissions from the source.

Conclusion and Recommendations

Based on the findings of this study and the consistency with results of similar studies, we conclude that eco-design capability is positively and significantly related to environmental performance. We therefore recommends that:

- 1. Food and beverages firms should devote more effort to eco-designed protect in the attempt to conserve resources as it was found to have the highest value. Since the relationship between 1 Eco-design capability has a very strong relationship with resource conservation.
- 2. Food and beverages firms should adopt emission reduction strategies as it will ensure that the goal of sustainable development goals can be achieved.

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