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Emerging practices in sustainable new product development: Evidence from Nigeria's Manufacturing SMEs

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Abstract

Globally, sustainability thinking has received widespread attention, but the approaches to integrating sustainability into the processes of developing new products are not very clear. This study was conducted to underscore the emerging sustainability practices deployed by small and medium-scale manufacturing entrepreneurs in Nigeria as they develop new products. It adopted the cross-sectional survey design which enabled the collection of primary data through the structured questionnaire from a sample of 364 manufacturing SME owners/operators. Data were analyzed using the mean, standard deviation, and graphical representation. The study found eight emerging sustainability practices adopted by manufacturing SMEs including sustainable product design, design for lifetime usage, design for quality, design for health and safety, product eco-labeling, design for recycling, eco-friendly design specification, and material waste reduction. Small and medium-scale manufacturers are encouraged to embrace sustainability in all facets of product design and development.

Keywords: Manufacturing, SMEs, development, sustainable

1. Introduction

Over the last twenty years, the sustainable performance of products and services has become one of the main aims of business enterprises (Ullah, 2021; Huang & Badurdeen, 2017) ^[40, 21]. Scholars and practitioners in both industrialised nations and emerging economies have also shown interest and insights into the concept, principles, and issues around sustainable product development (Ahmadi-Gh & Alejandro, 2021; Gmelin, & Seuring, 2014). Carmeli & Tishler, (2005) added that consumer's positive perception towards a company and its products tend to increase when they incorporate sustainability thinking in their product development function. Accordingly, the implementation of people and planet-friendly initiatives (Ullah, 2021; Gmelin, & Seuring, 2014) ^[40] in the design, production, and distribution of a product simply describes the concept of sustainable product development (SPD) (Schöggl, 2017) ^[35].

The need to design and produce environmentally friendly and socially responsive product is founded on the Brundtland Commission's (1987) report which described sustainability "as meeting today's needs without sacrificing the ability of future generations to meet their own needs". Today, companies such as Lenovo, Unilever, Adidas, and JET Motors amongst others have subscribed to the idea of integrating sustainability considerations into their product development (Henderson, 2011; Nejati *et al*, 2010) ^[18, 32]. Several nations including Denmark, Finland, Norway, Switzerland, and Sweden are at the forefront of demanding the disclosure of sustainability compliance as part of the effort to achieve sustainable development goals (SDG) (Onyinye & Amakor, 2019; Dilling, 2010; Global Reporting Initiative: 2000–2011; Joe-Myres, 2020) ^[34, 25].

In addition, a number of concepts and initiatives such as eco-design, green production, responsible production, design for sustainability, reuse, and recycling, have sprung up to aid the creation of more sustainable products (Garrette, 2009; Tim *et al.*, 2012) ^[11, 38].

These initiatives encourage companies to reduce the negative impacts of their product and production processes on the people and environment. Accordingly, sustainable product development advocates the design, production, and distribution of goods that balance the economic, social, and environmental needs of the present without risking the needs of future users. The concept highlights the firm's actions and decisions that take cognisance of the environmental and societal impact of their new product design, material sourcing and processing, and distribution and supply chain functions (Jabbour *et al.* 2015; Adams *et al.* 2016).

The idea of sustainability in new product development received a further boost from the Triple-Bottom-Line (TBL) model espoused by Elkington in the 1990s. The TBL emphasises the necessity to balance business operations in three sustainability performance pillars namely: planet, people, and profit (Hammer & Pivo, 2017; Onyinye, & Amakor, 2019; Milne & Gray, 2013)^[14, 34]. The planet dimension implies environmental consciousness, the people dimension speaks to corporate social responsibility, and profit sustainability is concerned with economic performance or competitive advantage. Consequently, organisations whose product development decision fails to maintain a balance between these three pillars have had to review their processes as the community and government continuously mount pressure (Onyinye & Amakor, 2019; Capitano *et al.*, 2011)^[34, 7].

1.1. Rationale

In recent times, studies have argued that SME firms aiming to receive positive reviews from customers or gain competitive edge must be willing to incorporate sustainable thinking and ideas in developing new products or in innovating the existing ones (Markley & Davis, 2007; Abhijeet, 2013)^[30, 2]. However, balancing a company's product development decision on the three dimensions of sustainability might be a difficult task to achieve due to its complexity. The complexity stems from differences in the country and industry characteristics of sustainability measures, and the non-uniformity in the manifold framework for evaluating and reporting sustainability (Carlos, 2019; Karyawati *et al.*, 2018; John *et al.*, 2022)^[28, 27].

In addition, while the idea of sustainability seems sensible and possibly advantageous to implement, there are reported issues surrounding its implementation. This ranges from cultural variation, lack of generally acceptable implementation framework, and regulatory and stakeholder needs variability that makes it perplexing for SMEs to uniformly adopt and implement (Laari *et al.*, 2016; Obal, Morgan, & George, 2020). In all these difficulties, very few empirical studies provide the mechanism in which sustainability can successfully be incorporated into the firm's product development plans (Schöggl, Baumgartner, & Hofer, 2017; Rosen & Kishawy, 2012)^[34].

It is acknowledged in environmental management literature that an important point of intervention in the quest towards ensuring sustainability is through the product development life-cycle (Finkbeiner *et al.*, 2010; Obal *et al.*, 2020)^[10]. The reason is that each phase in the lifecycle of a product presents a huge opportunity to address both environmental issues, social concerns, and economic performance (Hammer & Pivo, 2017; Onyinye, & Amakor, 2019; Milne & Gray, 2013)^[14, 34]. However, what has not been very clear in the sustainability literature (Boyer *et al.*, 2016; Abhijeet, Ashok

& Vivek, 2013)^[6, 2] relates to identifying the point in the product development process in which sustainability considerations can be implemented with the desired success. In other words, what drives firms' decision to incorporate sustainability initiatives into the new product development process is not well known and thus requires further investigation.

Moreover, little is known about the practices deployed by small-scale product manufacturers in Nigeria to incorporate sustainability into their product development processes. An understanding of these practices could provide direction and insights for other firms that might be contemplating the adoption of sustainability measures in product development.

Specifically, this study examines the following

- The emerging practices deployed by Nigerian manufacturing entrepreneurs to integrate sustainability considerations into new product development.
- The major drivers of sustainability decisions in new product development
- The challenges encountered by Nigerian manufacturing entrepreneurs in the process of integrating sustainability into new product development

1.2. Research Questions

The following research questions guided the study

1. How do Nigerian manufacturing entrepreneurs integrate sustainability considerations into new product development?
2. What are the major drivers of sustainability decisions in new product development?
3. What are the challenges that Nigerian manufacturing entrepreneurs might have encountered in the process of integrating sustainability into new product development?

2. Methodology

2.1. Research Approach and Design

The inductive approach was considered suitable and adopted for this study. The reason is because of our intention to validate the existing notion that integrating sustainability initiatives into the development of a new product has strategic gains. To ensure the achievement of its objectives, the cross-sectional survey design was preferred and deployed for the collection of relevant data (Russo *et al.*, 2021). The decision to adopt a cross-sectional survey was predicated on the need to collect a uniform set of data from a representative sample. Hair, Anderson, Tatham, & Black, (2009) assert that using a cross-sectional survey design helps the collection of relevant primary data in a more economical and speedy manner.

2.2 Sampling and Selection Criteria

Samples for the study consisted of all registered SMEs in the south-south geopolitical zone in Nigeria. This area was chosen because of the acknowledged increase in the emergence of start-up enterprises in the last five years (SMEDAN, 2023) compared to other zones in the nation. Therefore, 364 entrepreneurs were drawn randomly into the study from all six states that comprise the south-south zone. Eligible participants must have been in operation for at least 3 years and operate in the manufacturing subsector of the economy.

2.3 Data Collection, Measurement and Analysis

We collected relevant primary data using the structured

questionnaire. In designing the questionnaire, inputs were extracted from extant literature in the subject area (Sumit, *et al.*, 2015). The questionnaire items were scaled following the 5-point Likert scale where 5 represents the highest score and 1 represents the lowest score. Items were designed to measure three key study variables, namely: sustainability implementation practices; drivers of sustainability implementation, and barriers to incorporating sustainability into new product development. Accompanying the survey questionnaire was a cover letter that explained the purpose of the research, and sought informed consent from potential respondents. Responses from the questionnaire were then converted to data scores, summarised, and analyzed using percentages, mean(M), and standard deviation (SD). In line with modern practices (Sumit, Dangayach, Kumar, 2015) and where necessary, charts and graphs were employed to enhance the understanding of the results.

3. Results and Discussion

3.1. New Product Development Sustainability Practices

Incorporating sustainability requirements in designing and developing a new product is central to advancing the UN sustainability goals 13 and meeting the triple-bottom-line expectations (Janet and Gary, 2017) ^[23]. To support this argument, survey participants were requested to recognize, from a list of emerging sustainability practices employed throughout their product development cycle. Results in Table

1 show that generally, most of the sustainability initiatives were part of what is currently being implemented in the manufacturing industry. However, the highest-ranked emerging sustainability practices were: Designed for lifetime usage (M=3.42, SD= 0.89), designed for quality (M=3.33, SD= 1.21), designed for health and safety (M=3.32, SD= 1.05), eco-labeling (M=3.28, SD= 1.14), designed for recycling (M=3.22, SD= 1.11), and Eco-friendliness (M=3.20, SD= 1.14). Lifecycle packaging (M=3.28, SD= 1.14) was the lowest-ranked sustainability product development practice.

By ranking the practice of new product design for lifetime usage, participants seem to be suggesting that huge attention should be given to product longevity/life expectancy, a term widely gaining popularity as “the circular economy” (Jawahir *et al.*, 2017) ^[24]. Thus, these finding is consistent with prior studies such as Duflou *et al.*, (2018) and Schöggel, (2020) which advocated the need to incorporate sustainability features like longevity, eco-efficiency, eco-labeling, and environmental preservation into the product design stage as a necessity for building product durability. In addition, the high ranking of other sustainability attributes (eco-labeling, design for health and safety, design for quality) in the current study substantiates Khor and Udin’s (2013) position that integrating sustainability at the product design stage is crucial to the behavior of the product in the subsequent phases.

Table 1: Descriptive analysis of emerging sustainability practices for new product development

Sustainability variable	Emerging sustainability practice	Mean	SD	Rank
Design for Recycling	Products are designed with the potential for recycling	3.22	1.11	5
Eco-labeling	Products have eco-labelling features	3.28	1.14	4
Design for lifetime usage	Products are designed for prolonged lifetime usage	3.42	0.89	1
Design for health & and safety	Products are designed to mitigate health and safety hazards to employees	3.32	1.05	3
Design for quality	Attention is given to product quality	3.33	1.21	2
Lifecycle packaging	Lifecycle approach to product packaging	2.58	1.08	8
Eco-friendliness	Eco-friendly information on the product package	3.20	1.13	7
Material waste reduction	Every production batch is an opportunity to reduce material waste	3.21	1.08	6

3.2. Drivers of Sustainability in New Product Development

The drivers of sustainability in product development were identified by respondents as shown in Table 2. Items describe

the enablers of sustainability practices and explain why manufacturing SME owners considered implementing sustainability in the process of developing new products.

Table 2: Sustainability Drivers in New Product Development

Sustainability Drivers	Mean	Standard Deviation	Rank
Competitive strategy	3.32	1.06	2
Production costs reduction	3.31	1.23	3
Employee retention	3.04	1.06	6
Brand reputation	3.33	0.96	1
Community relevance	3.13	1.03	5
Customer requirements	3.17	1.10	4
Regulatory requirement	2.95	1.01	7
Environmental friendliness	3.13	0.63	8

As shown in Table 2, the major motivation for implementing sustainability in new product development processes includes the need to build reputation of their brand (M=3.33, SD=1.23); a source of competitive advantage (M=3.32, SD=1.06), a means of reducing costs of production (M=3.31, SD=1.23), to meet customer requirement (M= 3.17, SD=1.10), to remain relevant in the operating community (M= 3.13, SD= 1.03), to retain their employees (M= 3.04, SD= 1.06); and as a means of ensuring environmental

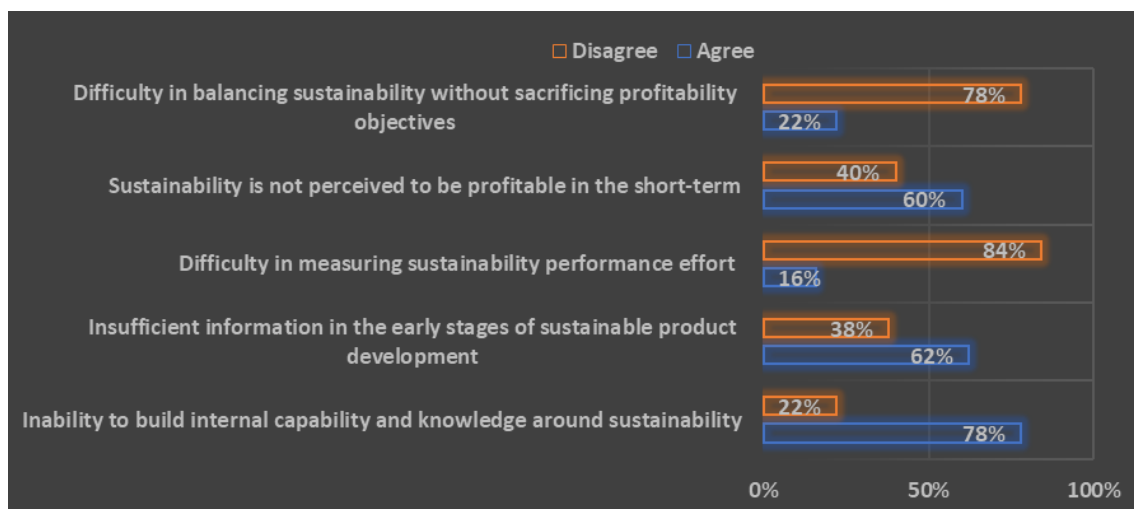
friendliness(M= 3.13, SD=0.63). As expected, the result is synonymous to prior studies such as Cooper, (2019) and Davies & Davies, (2017) whose empirical works all focuses on the barriers to incorporating sustainability practices and organisation’s outcomes. On the contrary, the results revealed that small scale production managers and owners were not prompted by regulatory pressure (M=2.95, SD=1.01) as suggested by prior studies such as Ehrenhard Muntslag & Wilderom, (2012).

3.3. Barriers to the implementation of sustainable product development

Result in figure 1 shows the various barriers to the incorporating sustainability into new product development experienced by small and medium scale manufacturing entrepreneurs. From all indications, the inability to build internal capability and knowledge around sustainability (78%) was ranked the greatest impediment to implementing sustainable product development.

This finding is true because despite the widespread attention to sustainability, one rarely finds indigenous corporate organisations in Nigeria establishing a distinct unit or department and saddle with specific sustainability-related functions. The few existing ones are usually found in multinational corporation and mostly having business

operation in the oil and gas industry. This result is in concordance with the research study carried out by Bubou *et al.*, (2015) which revealed the weak content of climate change-related courses in the engineering curriculum of some universities in Nigeria. The result in Figure 4.4 also shows that difficulty in measuring sustainability performance effort (16%) was the least agreed/rated barrier facing respondents. This is also in line with empirical evidence in Udofot & John, (2020) [39] relating to the entrepreneurial orientation of manufacturing SMEs and their supply chain performance. This finding contradicts that of Bey & Boks, (2016) which reported sustainability barriers related to performance measurement systems and access to information related to specific industry.



Source: Field Survey

Fig 1: Barriers to sustainability implementation

4. Conclusion

Consistent with the findings, a number of conclusions can be made in this study. First, the emerging sustainability approaches for developing new product relates to lifetime usage, design for quality, design for health and safety, eco-labelling, and design for recycling, eco-friendly design specification, sustainable material waste reduction, purchasing raw materials only from suppliers with reputable social responsibility records, and predictive and preventive maintenance.

Second, six enablers of sustainability implementation emerged from this study. They provide the motivations for implementing sustainability in product development. The enablers or drivers include the desire to build a strong brand reputation, sustainability being seen as a source of competitive advantage, the commitment to remain relevant within the operating community, sustainability being perceived as a means of reducing costs of production, and the need to reduce turnover and retain committed employees.

Third, the quest to incorporate sustainability thinking into the process of product development can be frustrated by several barriers. They include the inability to build internal capability and knowledge around sustainability, insufficient information about sustainability in the early stage of product development, difficulty in accurately measuring sustainability performance, sustainability not being perceived as profitable in the short term, and the difficulty in balancing sustainability without sacrificing profitability.

In light of the conclusion, there is a need for manufacturing SME owners and managers to be abreast with sustainability initiatives through continuous capacity development, learning, and education. Consequently, relevant national authorities and regulatory agencies are advised to put in place appropriate mechanisms to incorporate sustainability management in its entirety into the national policies. It is equally important that environmental awareness programs should form part of the policies and operating strategies for all entrepreneurs involved in the entire product development value chain and ecosystem.

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