



Green Packaging and Revenue Growth among Manufacturing Firms: The Moderating Role of Environmental Commitment



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Received: 05-30-2025

Revised: 09-02-2025

Accepted: 11-21-2025

Citation: D. N. Akude, J. K. Akuma, E. A. Kwaning, and I. K. Amoah-Ahinful, "Green packaging and revenue growth among manufacturing firms: The moderating role of environmental commitment," *Int. J. Environ. Impacts.*, vol. 9, no. 1, pp. 253–268, 2026. <https://doi.org/10.56578/ije090119>.



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Abstract: The present research endeavours to scrutinize the moderating influence of environmental commitment on the relationship between green packaging initiatives and the revenue growth of manufacturing firms. The research utilized a self-administered questionnaire methodology, accruing a total of 267 complete responses which were subsequently subjected to data analysis via Smart Partial Least Squares Structural Equation Modeling (PLS-SEM) (version 4). The findings elucidated a salient positive relationship between innovation in green packaging and revenue growth. In addition, a significant negative influence was identified in relation to regulatory compliance and its relationship with revenue growth. Conversely, the link between perceived communication and revenue growth was found to be insignificant. Furthermore, environmental commitment was evidenced to have a notable moderating effect on the relationship between regulatory compliance and revenue growth. Nevertheless, it was observed that environmental commitment did not exhibit a significant moderating influence on the interaction between perceived communication and revenue growth, nor did it impact the relationship between innovation in green packaging and revenue growth. This scholarly inquiry contributes novel insights concerning the critical role of environmental commitment in fortifying the nexus between green packaging and revenue growth, thereby underscoring relevant implications for theoretical frameworks, managerial practices, and overall business prosperity.

Keywords: Green packaging; Revenue growth; Environmental commitment; Innovation; Regulatory compliance

1 Introduction

With the escalation of global environmental issues, there exists an increasing demand from consumers and regulatory bodies for businesses to engage in sustainable practices. A significant transformation within manufacturing sectors can be observed in the form of the implementation of green packaging, which pertains to the deployment of materials and methodologies that seek to lessen ecological detriment [1]. Green packaging affords firms opportunities to promote their public standing, minimize waste outputs, and potentially sway consumer preferences. However, the direct correlation between such practices and revenue augmentation remains a matter of contention within scholarly discourse [2].

Recently, the manufacturing domain in Ghana has encountered heightened demands from both indigenous and foreign stakeholders, necessitating a transition towards more sustainable operational methods, particularly in packaging [3]. The concept of green packaging, exemplified by the utilization of eco-friendly materials and processes, is increasingly acknowledged as a viable strategic direction for mitigating environmental impact and bolstering corporate sustainability [4]. Nonetheless, Ghanaian manufacturing firms face unique challenges in adopting green packaging. These include high production costs due to the expensive nature of eco-friendly raw materials, limited consumer awareness that reduces demand for sustainably packaged products, weak regulatory enforcement which undermines consistent compliance with green standards, and infrastructural constraints such as inadequate recycling and waste management systems that restrict effective adoption [5]. These challenges make it difficult for firms to fully leverage the financial and reputational benefits of green packaging, thereby raising concerns about its short-term economic viability within Ghana's manufacturing sector.

A select number of investigations suggest that consumers who prioritize environmental factors are inclined to pay a premium for products that are packaged sustainably. However, converting this consumer willingness into definitive financial benefits for enterprises necessitates further investigation [6]. Yet, the degree to which green packaging can tangibly impact revenue growth is contingent upon myriad factors, inclusive of the firm's environmental dedication and the perception held by stakeholders [7]. Firms exhibiting a pronounced environmental commitment are likely to garner heightened financial returns from green packaging initiatives, as consumers may regard these firms as more genuine in their sustainability narratives [8, 9]. Furthermore, enterprises deeply committed to environmental sustainability are poised to reap more considerable advantages from green packaging due to the alignment of such initiatives with extensive corporate social responsibility frameworks [10]. Conversely, those businesses demonstrating feeble environmental aspirations may encounter difficulties in attaining notable financial returns from green packaging, as their endeavours may be perceived as superficial or merely nominal [11].

Despite this growing body of knowledge, a clear research gap remains: there is limited empirical evidence on the financial impact of green packaging adoption within Ghana's manufacturing sector. Existing studies largely emphasize consumer preferences, sustainability narratives, or regulatory perspectives, but few have systematically investigated whether and how green packaging translates into measurable revenue growth for firms in Ghana [12]. Addressing this gap is critical, as it will provide insights into the economic viability of sustainability-driven packaging practices in emerging markets, where firms often struggle to balance environmental responsibility with financial performance.

In response, this research aims to contribute to both theory and practice by investigating the nexus between green packaging and revenue growth within the Ghanaian manufacturing sector, with particular emphasis on the moderating role of environmental commitment. Explicitly, the objectives of this investigation are:

- To examine the extent to which green packaging adoption influences revenue growth among manufacturing firms in Ghana.
- To analyze the moderating role of environmental commitment in shaping the strength and direction of the relationship between green packaging and revenue growth.

In the ensuing segments of this manuscript, there shall be included summaries of extant literature pertaining to green packaging methodologies and the associated phenomena of revenue growth. Following this, an exposition of the methodological framework employed for the investigation shall be delineated. The subsequent segments will elucidate the analyses undertaken and the resultant findings. Ultimately, this paper will culminate with a discourse surrounding the emergent findings, alongside a consideration of their theoretical underpinnings and practical ramifications.

2 Literature Review

2.1 Theoretical Foundation and Hypotheses

The phenomenon of green packaging, alongside the progression of revenue, coupled with the intervening influence of environmental commitment, manifests as a multifaceted interaction within the sphere of manufacturing sectors. This examination of existing literature intends to amalgamate current theoretical frameworks and empirical studies to clarify the nexus among these variables.

2.2 Resource-Based View Theory

The Resource-Based View asserts that enterprises have the potential for competitive advantage through the utilization of distinct resources and capacities that possess characteristics of being valuable, rare, challenging to imitate, and lacking substitutes [13]. Therefore, green packaging can be envisioned as a strategic asset that organizations might employ for the purpose of distinguishing themselves within the competitive landscape. By embracing green packaging, businesses may cater to the preferences of environmentally conscious consumer demographics, which could lead to augmented brand loyalty and the acquisition of new clientele [7]. Furthermore, green packaging might be positioned as a mechanism of innovation facilitating the reduction of operational expenses via minimized material use, enhanced logistical efficiencies, and diminished waste. This may, in turn, contribute to heightened sales and profitability margins [14].

The employment of green packaging fosters product differentiation for businesses, traps the interest of environmentally aware consumers, and resonates with overarching sustainability movements [7]. In the context of Ghana, where the populace is increasingly attuned to sustainability challenges, green packaging could emerge as a significant asset, fortifying brand reputation and swaying consumer preferences. This dynamic could culminate in elevated revenue streams [15].

Nevertheless, the efficacy of green packaging as a catalyst for revenue generation is not inherently guaranteed. The Resource-Based View further elucidates that mere possession of resources does not inherently precipitate superior performance unless they are actively harnessed through ancillary capabilities. Within this frame, environmental commitment may be construed as a pivotal capability that intricately influences the nexus between green packaging and revenue growth. Organizations exhibiting robust environmental commitment are predisposed to integrate green packaging within an expansive sustainability framework, thereby harmonizing their operational practices with

customer anticipations, regulatory paradigms, and corporate social responsibility policies [16]. Such congruence may enhance consumer notions of authenticity, thereby amplifying their propensity to support the brand and contributing to revenue escalation [17].

Moreover, the Resource-Based View posits that organizations must cultivate the competence to seamlessly amalgamate green packaging with their overarching business strategies to effectively capitalize on this competitive edge [18]. Within this context, environmental commitment is a significant consideration. Enterprises demonstrating substantial environmental dedication are inclined to deploy green packaging in manners that are perceived as genuine and in concert with their holistic environmental objectives. This synergistic alignment holds the potential to magnify the favourable outcomes of green packaging on revenue growth by fostering enhanced ties between the organization and its customers as well as its stakeholders [2].

2.3 Dynamic Capabilities Theory

An extension associated with the Resource-Based View theory, the concept designated as Dynamic Capabilities Theory posits that organizational entities realize growth through the perpetual adaptation of their resources in response to fluctuating market conditions. Manufacturing entities, which cultivate proficiencies pertinent to innovation, enhancement of processes, and responsiveness to market dynamics, tend to be situated more favourably for the exploitation of emergent opportunities, sustaining competitive stance, and augmenting revenue streams [19]. This conceptual framework underscores the criticality of agility along with strategic flexibility as central drivers of sustained growth in the long term. Within the confines of revenue augmentation, Dynamic Capabilities Theory delineates a strategic outline aimed at elucidating how corporate bodies maintain profitability while concurrently expanding their revenue through an ongoing process of adaptation and innovation.

Dynamic capabilities entail the recognition of market opportunities and potential threats, the appropriation of these through deliberate strategic allocation of resources and innovative practices, as well as the reconfiguration of said resources to align with marketplace fluctuations. Manufacturing firms that adeptly monitor consumer preferences, advancements in technology, and shifts in regulatory frameworks are positioned to engage with emergent trends, such as the adoption of environmentally sustainable packaging solutions. Through financial investment in technology and comprehensive training programs, these firms can effectively harness growth opportunities, foster operational efficiencies, and increase revenue generation. The reconfiguration of resources allows for the optimization of operational practices and the attraction of alternative customer demographics. An unending commitment to innovation and organizational learning is crucial for establishing a competitive edge and perpetuating revenue escalation [20].

Contemporary research endeavours furnish empirical substantiation of the link between dynamic capabilities and revenue growth. Findings indicate that entities characterized by elevated levels of dynamic capabilities tend to eclipse their competitors concerning revenue enhancement via effective responsiveness to market fluctuations [21]. In a study focused on manufacturing corporations, it was observed that entities possessing dynamic capabilities were capable of promptly executing digital transformation initiatives, contributing to improvements in operational efficacy and consequential revenue increase [22]. Additionally, it was documented that firms which are in a constant state of developing novel capabilities in alignment with customer-centric needs, sustainability parameters, and technological evolution experienced growth in market share alongside improved financial performance [23].

2.4 Signaling Theory

Signaling theory contributes to the understanding of how the commitment to environmental efforts plays a mediating role regarding the connection between the implementation of green packaging strategies and revenue growth. As posited by study [24], firms undertake the act of signaling to external stakeholders regarding their intrinsic quality and intentions. Specific indicators of environmental commitment from firms may include eco-certifications, sustainability documentation, and green labeling, all of which aim to showcase a genuine dedication to sustainable practices [25]. The credibility attributed to these signals is reliant on their imitation costliness and the perceived authenticity of the firm's reputation [26]. Effectively executed signaling can bolster a firm's public perception, entice consumers who are environmentally conscious, and garner trust from investors [27]. From a strategic viewpoint, it may furnish competitive edges by creating market differentiation, reducing regulatory threats, and attracting investors focused on environmental, social, and governance principles, thereby enhancing brand recognition and market stature [28].

Green packaging operates as a conveyance of a firm's commitment to sustainable principles, thus communicating its environmental ethos to consumers and stakeholders [29]. However, the efficacy and trustworthiness of this communicative signal hinges upon the firm's overarching environmental operations [30].

Firms demonstrating robust environmental commitment are predisposed to deliver consistent and credible signals corresponding to their sustainability endeavours. This continuity serves to amplify the perceived worth of their green packaging initiatives, rendering consumers more likely to engage in purchasing behaviour pertaining to their products. Conversely, firms that exhibit weak environmental commitment may encounter skepticism from the consumer base,

which could interpret their green packaging initiatives as merely superficial attempts at sustainability, hence potentially obstructing revenue growth [8].

Notwithstanding, challenges are inherent within the signaling framework. The peril of “greenwashing,” in which firms might disseminate inflated or deceptive assertions regarding their environmental initiatives, can detract from the credibility of their signals [31]. Consequently, firms must endeavour to substantiate their environmental claims through genuine actions and ensure transparency in their reporting processes. The role of independent validation and compliance with established standards emerges as pivotal for preserving the authenticity of environmental signaling [32].

2.5 Green Packaging and Revenue Growth

Management practices that are deemed appropriate have the potential to enhance the operational efficacy of firms [33, 34]. Within the realm of these practices is the concept of green packaging applied to a firm’s products. An array of empirical investigations has demonstrated a constructive correlation between green packaging and revenue growth within manufacturing entities. Consequently, the adoption of green packaging has the capacity to markedly enhance a firm’s competitive edge by appealing to consumers who are environmentally aware, which consequently catalyzes an increase in product demand and, subsequently, revenue [2].

In research concentrating on manufacturing companies in China, some authors discerned that organizations employing green packaging recorded a 12% enhancement in revenue growth relative to their counterparts that did not incorporate such methodologies [35]. The investigation underscored that green packaging serves not merely to differentiate products, but also to bolster operational efficacy by employing recyclable materials, thus diminishing costs and enhancing profit margins. Notably absent from the literature is the exploration of the applicability of these findings to manufacturing firms situated within the Ghanaian context. This absence is particularly significant considering the cultural and regulatory distinctions that exist between China and Ghana, suggesting that replicating this investigation within the Ghanaian manufacturing sphere may yield valuable insights.

Correspondingly, it was noted that enterprises within the food and beverage manufacturing domain that integrated green packaging reported a revenue increase across a three-year timeframe [36]. Longitudinal analysis, executed in Malaysia, unveiled that firms investing in green packaging not only attracted a greater number of environmentally conscious consumers, but also observed heightened brand loyalty, which manifested as sustained revenue growth. The study credited this revenue surge to the growing demand for sustainable products, particularly among younger consumer demographics who exhibit a preference for sustainability in their purchasing behaviors.

The current paper operationalizes green packaging to denote the application of paper and recycled materials in product packaging. However, it has been proposed that, a more comprehensive framework encompasses innovation in green packaging, regulatory adherence in green packaging, and the perceived communication of green packaging [37]. Innovation in green packaging pertains to the degree to which a firm allocates resources to research and development to devise suitable green packaging materials. Regulatory adherence relates to compliance with established norms when engaging in green packaging. Perceived communication pertains to how well firms convey the significance of their green packaging initiatives to consumers [38]. Investigations focusing on these specific dimensions remain unspecified.

The strategy of green packaging, which entails the utilization of recyclable, biodegradable, or reusable materials, possesses the capability to bolster a company’s competitive edge by aligning with consumer environmental priorities [2]. Nevertheless, empirical studies assessing the ramifications of green packaging on revenue growth within Ghana are markedly limited. For instance, a noteworthy positive correlation between green packaging practices and consumer behavior was identified [39]. Firms that adopted green packaging observed a notable 15% favorable shift in consumer behavior over a two-year span. Furthermore, the authors associated this with enhanced consumer perceptions of corporate responsibility and alignment with global environmental criteria. However, this particular investigation did not elucidate the degree to which alterations in consumer behavior were contributory to revenue increments.

Moreover, a study scrutinized the financial performance of Ghanaian firms that implemented suitable green packaging practices [40]. Their findings revealed a substantial linkage between green packaging and financial performance, with firms noting a 15% increase in financial performance attributable to enhanced consumer allegiance and market differentiation. Additionally, the green packaging initiatives were found to result in cost reductions through diminished waste and material consumption, thus contributing to improved profit margins. These results resonate with other scholarly works that imply a favorable relationship between the adoption of green practices and various performance metrics [41].

The assertion that consumer demand and operational efficiency can be augmented, subsequently enhancing financial performance, is supported by the works [9, 42]. These examinations concentrated on financial performance in rather broad paradigms. It is of critical importance to conduct an investigation that directly correlates green packaging practices within manufacturing organizations specifically to their sales and revenue growth. This significance is underscored by the premise that an uptick in sales represents a pivotal locomotive for profitability, business expansion,

in addition to contributing to the alleviation of unemployment figures [43].

Furthermore, a body of empirical literature emphasizes the beneficent influences of green packaging practices on brand loyalty, which in turn catalyzes sustainable financial performance over protracted periods. The interplay between green packaging practices and customer retention within the food and beverage manufacturing industry in Ghana was scrutinized [44]. These findings illustrated that enterprises that embraced sustainable packaging methodologies noted a 10% escalation in repeat purchasing behaviors, primarily attributed to elevated consumer perceptions regarding the company’s dedication to environmental sustainability. This growth in customer loyalty was found to have a direct correlation with financial returns over a triad of years. Such results imply that consumers in Ghana, akin to those on a global scale, exhibit a burgeoning preference for firms that manifest environmental stewardship, which in turn stimulates the demand for products nestled within green packaging paradigms. Contrarily, it was advocated for contemporary investigations into green packaging to further integrate frameworks surrounding innovation, regulatory compliance, as well as perceived communication pertaining to green packaging [37]. Consequently, the following hypotheses have been proposed.

- H1:** There is a statistically significant relationship amid green packaging as well as revenue growth.
- H1a:** There is a statistically significant relationship amid innovation in green packaging as well as revenue growth.
- H1b:** There is a statistically significant relationship amid regulatory compliance as well as revenue growth.
- H1c:** There is a statistically significant relationship amid perceived communication as well as revenue growth.

2.6 The Moderating Role of Environmental Commitment

The implementation of green packaging, supported by a strong environmental commitment, enhances the optimization of financial benefits. The disconnect between adopting green packaging tactics and failing to underpin these initiatives with genuine sustainability efforts can result in adverse consumer responses, thereby diminishing the anticipated positive impact on revenue.

Henceforth, there exists a notable trend within the extant literature which underscores the imperative for firms to not solely adopt green packaging practices but concurrently establish a robust framework of environmental commitment that informs and supports their operations. It is worthy of note that the articulation of a cohesive strategy that intertwines green packaging with broader environmental goals enhances the legitimacy of these efforts in the eyes of both consumers and stakeholders, illustrating a clear pathway to sustained financial performance [45].

Furthermore, it was critically highlighted that productive firms in China were those that effectively linked their green packaging initiatives to rigorous environmental management policies, which yielded superior financial results compared to their less committed counterparts [46]. The correlation drawn between proactive environmental strategies and improved consumer trust suggests that revenue growth is contingent not solely upon the operationalization of green packaging, but also on the depth of environmental commitment to substantiate such commitments.

Consequently, it is essential for future empirical inquiries to delve into the modulating influence of environmental commitment on the nexus between green packaging and financial growth, as articulated by study [13]. With the ongoing evolution in consumer expectations and heightened scrutiny over corporate environmental practices, firms that overlook the significance of robust environmental commitment risk falling short of attaining the optimal benefits of green packaging. Utilization of eco-friendly packaging alongside genuine and uniform environmental efforts is imperative in order to mitigate adverse consumer viewpoints and to optimize the economic advantages associated with green packaging. Accordingly, the following hypotheses have been suggested.

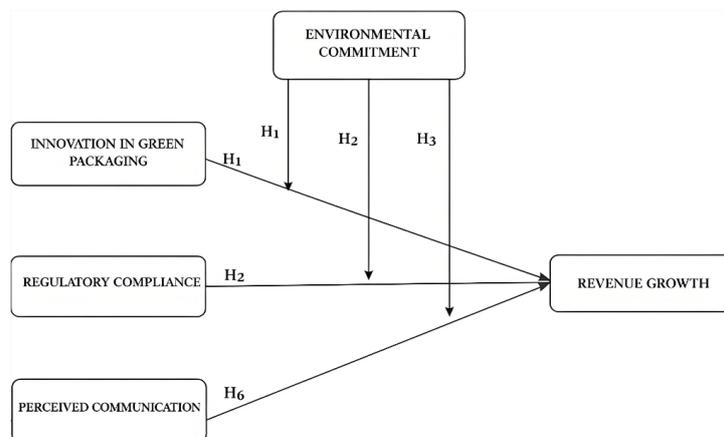


Figure 1. Conceptual framework

H2: There is a statistically significant moderation effect of environmental commitment on the relationship amid green packaging as well as revenue growth.

H2a: There is a statistically significant moderation effect of environmental commitment on the relationship amid innovation in green packaging as well as revenue growth.

H2b: There is a statistically significant moderation effect of environmental commitment on the relationship amid regulatory compliance as well as revenue growth.

H2c: There is a statistically significant moderation effect of environmental commitment on the relationship amid perceived communication as well as revenue growth.

The proposed conceptual framework guiding this study is presented in Figure 1.

3 Methodology

3.1 Survey Instrument

The instrument for the survey was constructed through the selection of an existing questionnaire from academic literature aimed at evaluating the various elements of the research model in question. By utilizing data gathered from a survey sample, the validity and reliability of the instrument were systematically evaluated, alongside an examination of the proposed relationships. The types of questions designed for assessing the concept of green packaging underwent modifications as reported by Mishra [47]. Furthermore, adjustments were made to the questions intended to gauge revenue growth as indicated by studies [48, 49], while the items aimed at measuring environmental commitment were similarly altered in accordance with the works [50, 51]. To facilitate the investigation, a 5-point Likert scale was employed. In addition, the questionnaire items were validated using constructs tested in prior studies and subjected to a pre-test involving three academic experts in marketing, finance, and accounting to ensure content validity, clarity, and contextual relevance to the Ghanaian manufacturing sector [52].

3.2 Sampling and Data Collection

The cross-sectional survey framework established a population encompassing 634 manufacturing entities that were documented with the Association of Ghana Industries (AGI) in the year 2024. These entities were subsequently classified according to the nature of their produced goods. The research methodology predominantly utilized the formula articulated by Krejcie and Morgan [53] for ascertaining the minimal requisite sample size.

$$S = \frac{X^2 NP(1 - P)}{d^2(N - 1) + X^2 P(1 - P)}$$

where,

S = the required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

p = the population proportion assumed to be 0.5 since this would provide a maximum sample size.

d = the degree of accuracy expressed as a proportion (0.05).

Per the methodologies established in the Krejcie and Morgan [53] sample size determination formula, with a designated targeted populace comprising 634 registered entities in the realm of manufacturing, the baseline sample size requisite for the accomplishment of this survey, at a confidence threshold of 95% coupled with a margin of error set at 0.05, is quantified as 242. To enhance representativeness, the sample of 285 firms was selected through simple random sampling across multiple subsectors (food and beverages, chemicals, textiles, metals, and plastics), reflecting the broader structure of Ghana's manufacturing sector as classified by the AGI. This ensured that the sample captured both small- and medium-scale enterprises as well as larger firms, thereby increasing generalizability of the findings [54].

A total of 285 questionnaires were disseminated leveraging Google Forms. Consequently, 267 completed questionnaires were retrieved, thereby resulting in a response rate calculated at 93.6%. Each questionnaire was duly filled out by a managerial figure representing each corresponding firm. This managerial-level participation ensured that responses were informed by strategic and operational perspectives [55].

3.3 Data Analysis

The analysis of statistical data was conducted via SmartPLS software, version 4.0, with the objective of examining the interconnections that exist between green packaging practices and revenue growth, with environmental commitment as the moderator [56]. The use of Partial Least Squares Structural Equation Modeling (PLS-SEM) was deemed appropriate given its robustness in handling complex models with moderating effects, its emphasis on prediction-oriented analysis, and its suitability for relatively smaller sample sizes compared to covariance-based Structural Equation Modeling (CB-SEM) [57, 58]. Furthermore, PLS-SEM has been increasingly applied in sustainability and green marketing research where theoretical development and prediction are prioritized [58].

In the framework proposed by Hanafiah [57], it has been recommended that indicators which measure a construct within the structural modeling context should achieve a threshold of 0.70 when employing validated constructs. This guideline ensures the reliability of the research instruments, attributable to the fact that such indicators account for over 50% of the variance associated with the indicator. Given that the current study has incorporated validated constructs from previously conducted research, a reliability assessment was implemented using these indicators, adhering to a minimum reliability standard of 0.70.

3.4 Profile of Respondents

A cumulative total of 267 valid responses was amassed for statistical analysis purposes. Among respondents, males predominated (64.5%, $n = 172$), compared to females (35.5%, $n = 95$). Reflecting contemporary adult age categorization, respondents were classified as young adults (19–34 years), early middle-aged adults (35–49 years), and late middle-aged adults (50–65 years).

Analysis divulges that young adults constituted 39% ($n = 104$) of the sample, middle-aged adults represented 53% ($n = 72$), and senior adults accounted for a mere 8% ($n = 21$). This signals a substantial majority of middle-aged managers within the respondent pool. Such demographic parameters suggest that the respondents possess a degree of maturity and experience that may enhance their capacity to contribute pertinent insights relating to the green marketing communication strategies employed by their respective organizations.

In terms of professional positions occupied by the respondents, it was noted that 16.7% ($n = 45$) occupied roles as Chief Executive Officers (CEOs) or General Managers, while 58.7% ($n = 157$) identified as senior managers. Additionally, 12.5% ($n = 8$) were classified as board members, and 12.1% ($n = 32$) were recognized as middle-level managers. Collectively, this denotes that a substantial 75.6% ($n = 22$) of the total respondents hailed from senior management or executive tiers. The expertise and extensive professional experience of these upper-echelon respondents thus position them as capable sources to provide informed and high-caliber responses ostensibly regarding their organization’s green communication practices.

4 Results

4.1 Evaluation of Measurement Model

The evaluation of the measurement framework was conducted through the application of PLS-SEM (version 4). The conceptual framework for this study was composed of three principal components: green packaging, revenue growth, and the notion of environmental commitment as illustrated in Figure 2.

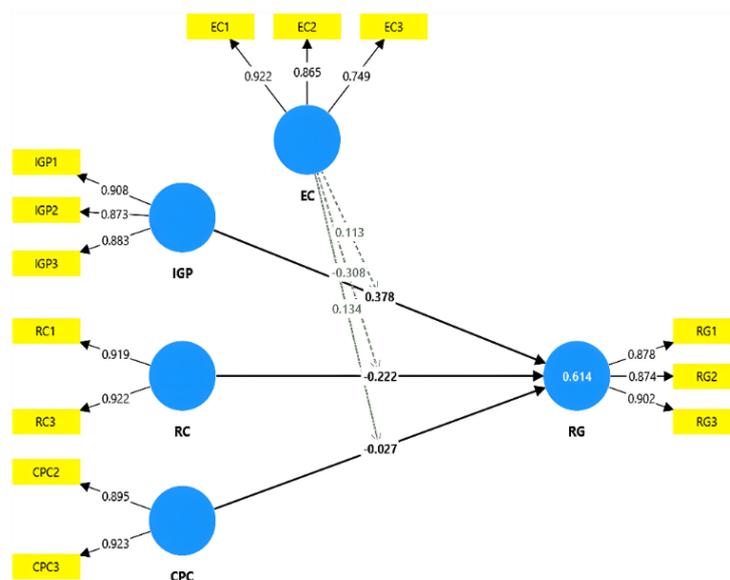


Figure 2. Measurement model

Note: CPC = Perceived communication, EC = Environmental commitment, IGP = Innovation in green packaging, RC = Regulatory compliance, RG = Revenue growth.

In the context of evaluating the measurement model, there were particular focal points on assessing several key aspects such as construct reliability, convergent validity, and discriminant validity, as elucidated by studies [56, 58]. Specifically, the criterion for reliability is met when certain statistical measures, namely Cronbach’s alpha, composite reliability denoted as (ρ_a), and another composite reliability referred to as (ρ_c), all attain a threshold value

of no less than 0.7, which is supported by findings in study [58]. Furthermore, with respect to convergent validity, it is requisite that the average variance extracted, abbreviated as AVE, surpasses the value of 0.5, as discussed by study [57].

Table 1 illustrates that the various items and constructs pertinent to this study exhibit sufficiently acceptable levels of convergent validity and reliability across the constructs employed herein. The research employed the heterotrait-monotrait (HTMT) ratio as a means of assessing discriminant validity [54]. In order to confirm the discriminant validity, it is requisite that the HTMT ratio for each construct is maintained below the threshold of 0.9 [56]. The outcomes pertaining to HTMT are delineated in Table 2, which indicates that the discriminant validity is deemed satisfactory.

Table 1. Cronbach alpha, composite reliability rho_a, composite reliability rho_c and average variance extracted (AVE)

Construct	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	AVE
CPC	0.791	0.802	0.905	0.826
EC	0.806	0.877	0.885	0.720
IGP	0.866	0.869	0.918	0.789
RC	0.820	0.821	0.918	0.848
RG	0.861	0.867	0.915	0.783

Note: CPC = Perceived communication, EC = Environmental commitment, IGP = Innovation in green packaging, RC = Regulatory compliance, RG = Revenue growth.

Table 2. Discriminant validity assessment (heterotrait-monotrait)

	CPC	EC	IGP	RC
EC	0.780			
IGP	0.767	0.762		
RC	0.831	0.787	0.720	
RG	0.578	0.836	0.715	0.486

Note: CPC = Perceived communication, EC = Environmental commitment, IGP = Innovation in green packaging, RC = Regulatory compliance, RG = Revenue growth.

4.2 Evaluation of the Structural Model

The structural model must be appraised to scrutinize the interrelationship amid green packaging practices as well as revenue growth. Consequently, the hypotheses of the investigation were tested.

4.2.1 Collinearity assessment

The assessment of collinearity within latent variables is conducted via the Variance Inflated Factor (VIF). As per the guidelines provided by Akude et al. [58], a VIF threshold of 5 or greater serves as an indicator of potential collinearity complications. The outcomes delineated in Table 3 reveal that all computed VIF values remain beneath the threshold of 5, thereby suggesting an absence of any significant collinearity issues within the model. As a result, one can infer that the model is not susceptible to common method bias as posited by Hanafiah [57].

Table 3. Inner Variance Inflated Factor (VIF)

Path	VIF
CPC → RG	2.952
EC → RG	2.770
IGP → RG	2.670
RC → RG	2.236

Note: CPC = Perceived communication, EC = Environmental commitment, IGP = Innovation in green packaging, RC = Regulatory compliance, RG = Revenue growth.

The evaluation of path coefficients must be undertaken alongside both the R -square (R^2) and the Stone-Geisser criterion (Q^2) in the context of green packaging and its consequential association with revenue growth, which is integral for assessing the structural model [54]. High R^2 values, specifically 0.67 attributed to revenue growth, are interpreted as substantial within the domain of behavioral sciences [55]. This signifies that approximately 61.4% of the variance in revenue growth can be ascribed to the identified predictors. It is pertinent to acknowledge that this explained variance surpasses the baseline R^2 threshold of 25%, as delineated by Sarstedt et al. [56].

In alignment with the observations of study [58], it is crucial that the assessment of Q^2 exceeds zero to substantiate the predictive capability of the structural model; in this analysis, a Q^2 value of 0.583 emerged for revenue growth. These figures corroborate the model's commendable predictive efficacy.

The factors constituting innovation in green packaging, regulatory compliance, perceived communication, and environmental commitment each exert a positive influence on revenue growth, in that order of significance. Notably, environmental commitment exerts the most substantial impact on revenue growth, subsequently followed by innovation in green packaging, perceived communication, and regulatory compliance.

4.2.2 Hypotheses testing (direct effect)

As a conclusion of the direct effect, two of the three hypotheses were supported; innovation in green packaging to revenue growth ($\beta = 0.378, p < 0.01$), regulatory compliance to revenue growth ($\beta = -0.222, p < 0.01$). However, perceived communication to revenue growth is insignificant ($\beta = -0.027, p = 0.78$); as can be demonstrated in Table 4.

Table 4. Hypotheses analysis

Path	Original Sample (O)	f^2	t -Statistics (O/STDEV)	p -Value	Decision
CPC → RG	-0.027	0.001	0.341	0.780	Not supported
IGP → RG	0.378	0.139	5.266	0.000	Supported
RC → RG	-0.222	0.057	3.210	0.001	Supported

Note: CPC = Perceived communication, EC = Environmental commitment, IGP = Innovation in green packaging, RC = Regulatory compliance, RG = Revenue growth.

The inquiry additionally evaluated the magnitude of effect size (f^2), utilized as an indicator of the significance of a particular exogenous construct on an outcome variable. In accordance with Hanafiah's [57] recommendations, the findings of the inquiry indicated that the dimension of innovation in green packaging and compliance to regulatory frameworks exhibits a small effect on revenue growth, in respective analyses. Conversely, it was ascertained that perceived communication does not exert any discernible influence on revenue growth whatsoever.

4.2.3 Moderation effect

One of the current research hypotheses was to appraise the moderation role of environmental commitment on the link amid green packaging as well as revenue growth. Moderation is characterized by a situation wherein the interplay between two concepts does not exhibit a seamless or uninterrupted continuum; rather, it is contingent upon the value of an intermediary variable that is specified as a moderator [56].

In this regard the appraisal of the moderation effect was applied. It is worthy of note that environmental commitment has a significant negative moderation effect ($\beta = -0.308, p < 0.01$) on the relationship amid regulatory compliance and RG. Furthermore, environmental commitment has an insignificant moderation effect ($\beta = 0.134, p = 0.101$) on the relationship amid perceived communication and RG. Moreover, environmental commitment has an insignificant moderating effect ($\beta = 0.113, p = 0.189$) on the relationship between innovation in green packaging and revenue growth (Table 5).

Table 5. Hypotheses testing (moderation effect)

Path	Original Sample (O)	f^2	t -Statistics (O/STDEV)	p -Value	Decision
EC × CPC → RG	0.134	0.016	1.641	0.101	Not supported
EC × RC → RG	-0.308	0.074	3.622	0.000	Supported
EC × IGP → RG	0.113	0.011	1.315	0.189	Not supported

Note: CPC = Perceived communication, EC = Environmental commitment, IGP = Innovation in green packaging, RC = Regulatory compliance, RG = Revenue growth.

Subject to Cohen's [59] suggestion, Table 5 further indicates that the moderation role of environmental commitment has no effect on the relationship between perceived communication ($f^2 = 0.016$) and revenue growth. Furthermore, the moderation role of environmental commitment had a small effect on the relationship amid regulatory compliance ($f^2 = 0.074$), and revenue growth. Moreover, the moderation role of environmental commitment has a small effect on the relationship amid innovation in green packaging ($f^2 = 0.011$) and revenue growth.

5 Discussion

Engrained in the theoretical framework of Resource-Based View, dynamic capability theory, accompanied by signaling theory, this study engaged in the exploration of the moderating influence exerted by environmental commitment on the nexus intertwining green packaging and the ensuing revenue augmentation of manufacturing

entities. Our findings explicitly furnish empirical validation for the pivotal contribution of environmental commitment in moderating the interplay between green packaging and the financial growth trajectory of manufacturing firms.

In a broader context, two out of three hypotheses associated with the direct effects received support (refer to Table 4). The examination revealed a noteworthy negative relationship between regulatory compliance and the revenue growth of manufacturing firms. Such an observation underscores the financial and operational tribulations entwined with the adherence to regulatory mandates. Compliance frequently necessitates considerable expenditure and may disrupt operational fluidity, thereby undermining productivity and overall efficiency. In light of this, it becomes imperative for firms to judiciously apportion resources to harmonize compliance endeavors with growth aspirations, concentrating on innovation and operational efficacy to mitigate compliance-related financial burdens. Policymakers should endeavor to craft regulations that facilitate the dual objectives of compliance and commercial proliferation, potentially introducing financial incentives or providing technical support to alleviate the compliance strain whilst promoting a more equitable balance between regulatory conformity and revenue growth.

Moreover, a positive and significant relationship emerged between innovation in green packaging and the revenue growth of manufacturing firms. This finding accentuates the inherent worth of practices centered around environmental sustainability. The escalating consumer inclination towards eco-conscious products compels firms to integrate green packaging, thereby amplifying market attractiveness and augmenting brand differentiation. Such a strategy not only resonates with consumer ideologies but also aids firms in navigating regulatory frameworks whilst broadening market prospects. Targeted investments in green packaging, alongside efficacious communication regarding its merits and collaborative efforts with relevant stakeholders, can catalyze revenue elevation. Additionally, it is vital for firms to comprehend consumer predilections and to evaluate the ramifications of green packaging on sales metrics as a means to optimize organizational performance and nurture consumer loyalty.

Conversely, the relationship between perceived communication and revenue growth manifested as negative, albeit devoid of statistical significance. This implies that efficacious communication does not necessarily yield immediate monetary benefits. While enhanced communication might bolster brand allegiance and trust, its revenue implications may unfold over a protracted period. Influencing elements such as disparate consumer priorities, market saturation levels, and predominant factors like product quality or pricing strategies may overshadow the effects of communication. Furthermore, inconsistencies between communication efforts and consumer anticipations, in conjunction with the phenomenon of communication fatigue prevalent in the digital era, may serve to diminish its efficacy. Another plausible explanation lies in consumer skepticism and concerns about greenwashing, which can undermine trust in corporate sustainability claims. When consumers perceive sustainability messaging as disingenuous or inconsistent with actual practices, communication loses credibility, thereby reducing its capacity to translate into revenue growth.

The forthcoming hypothesis scrutinized the moderating role of environmental commitment concerning the connection between green packaging and revenue growth (refer to Table 5).

The investigation elucidated a noteworthy negative moderation effect of environmental commitment on the relationship between regulatory compliance and revenue growth. The findings of the study imply that enterprises exhibiting substantial environmental commitment may encounter diminished immediate fiscal benefits. This phenomenon is presumably attributable to the supplementary expenses incurred in exceeding regulatory stipulations, including investments in progressive sustainability measures, which exacerbate resource allocation issues.

A deeper exploration of this outcome suggests that high compliance costs represent a significant burden for many firms. Regulatory standards often necessitate the adoption of new technologies, specialized training, and the restructuring of operational processes, which may divert financial resources away from core revenue-generating activities. Moreover, firms operating in emerging economies such as Ghana typically face resource constraints, including limited access to green financing, insufficient technical expertise, and infrastructural gaps, which makes it difficult to realize immediate financial returns from compliance initiatives. Implementation challenges further aggravate this relationship, as the transition to green packaging and environmentally sustainable practices often involves supply chain disruptions, higher production costs, and resistance from stakeholders accustomed to conventional practices. These factors collectively contribute to the diminished short-term fiscal gains associated with strong environmental commitment.

Furthermore, consumer skepticism pertaining to greenwashing, alongside difficulties in effectively articulating the valuation of environmental initiatives, may inhibit the affirmative repercussions of regulatory compliance. Even when firms exceed compliance requirements, markets may not fully reward such efforts if customers are uncertain about the authenticity of green claims or lack awareness of the long-term benefits of sustainable packaging [60]. Compounding factors integral to specific industries and the market's preparedness for sustainable methodologies further complicate this interplay, which results in a lessened financial yield stemming from environmental commitment.

Moreover, the moderation role of environmental commitment on the relationship amid perceived communication as well as revenue growth was positively insignificant. The results of this inquiry imply a multifaceted relationship residing amidst sustainability initiatives and fiscal outcomes. Although a strong commitment to environmental practices serves to bolster a corporation's public image, this enhancement does not necessarily correlate with augmented

revenue solely via communicative endeavors. Various elements, including the level of consumer cognizance, market fluctuations, and the phenomenon of message oversaturation, may constrain the monetary repercussions associated with sustainability-oriented communication. Furthermore, it is noteworthy that certain demographic segments of consumers may prioritize alternative considerations above environmental sustainability. Hence, a substantive coherence between an organization's environmental strategies and their corresponding communicative efforts emerges as crucial for the effective stimulation of revenue augmentation, particularly in contexts characterized by price sensitivity or within sectors that exhibit a diminished focus on sustainability.

In addition, the moderating influence of environmental commitment on the linkage between innovation in green packaging and revenue growth remains positively insignificant (refer to Table 5). The implications that arise from this particular finding imply that, despite the potential for green packaging to influence revenue in a standalone manner, the existence of environmental commitment does not notably enhance or reduce this effect. This occurrence may be attributed to the complex characteristics inherent in environmental commitment, variations in how markets perceive such commitments, differing degrees of efficacy in the implementation of various strategies, or potentially delayed repercussions related to revenue outcomes. Therefore, it is crucial for professionals in the field to adopt a holistic approach that not only incorporates green packaging but also interweaves a range of other strategic actions, thereby underscoring the significance of product quality alongside consumer attraction. An in-depth comprehension of consumer inclinations coupled with current market dynamics is vital to maximize the effectiveness of initiatives aimed at green packaging, particularly in terms of promoting revenue growth.

6 Conclusion and Implications

6.1 Conclusion

The notably adverse correlation discerned between consumer adherence to regulatory frameworks and the fiscal expansion of manufacturing enterprises accentuates the complexities inherent in reconciling regulatory compliance with economic efficacy. While it is acknowledged that compliance is critical for both legal and operational imperatives, organizations are necessitated to devise methodologies aimed at ameliorating the repercussions of compliance on revenue streams. Deploying strategic resource distribution, fostering innovation, and advocating supportive policy initiatives are essential for confronting these quandaries and promoting enduring growth trajectories.

The notable positive correlation identified between innovations in ecological packaging and revenue expansion accentuates the merit of embedding sustainability within corporate operational frameworks. By embracing avant-garde eco-conscious packaging alternatives, manufacturing entities can harmonize their operations with consumer inclinations, elevate brand distinctiveness, and ensure conformity with regulatory stipulations. Strategic financial commitments toward eco-friendly packaging, amalgamated with robust communication and consumer enlightenment efforts, possess the potential to catalyze revenue escalation and fortify market standings.

Additionally, the identification of a negative yet statistically non-significant association between perceived communication and the revenue trajectory of manufacturing establishments implies that, despite the influence of communication in shaping consumer impressions and brand esteem, it occasionally fails to exert a direct effect on fiscal results. The intricate interrelationship between communication efficiency, consumer anticipations, market variances, and industry-specific contexts may elucidate this observation. Notwithstanding the absence of immediate significance, perceived communication remains an indispensable element of enduring business strategy formulation and brand development.

The pronounced detrimental moderating effect of environmental commitment on the nexus between regulatory compliance and revenue expansion elucidates the intricate balancing act required to harmonize regulatory adherence with sustainability endeavors. Although regulatory compliance persists as a pivotal factor propelling revenue enhancement, entities exhibiting robust environmental commitments may encounter waning returns attributed to heightened expenditures, market impediments, and consumer skepticism regarding sustainability initiatives.

While environmental commitment constitutes a significant element in sculpting brand perception and long-term viability, its capacity to serve as a moderator in the interaction between perceived communication and revenue growth appears constricted in the immediate context. This assertion intimates that businesses must judiciously amalgamate their sustainable practices with communication strategies, warranting that messaging resonates with consumers and is substantiated by authentic, impactful initiatives.

Moreover, although environmental commitment does not seem to materially moderate the relationship between ecological packaging innovation and revenue growth within the confines of this study, the findings yield salient insights for both industry practitioners and academic researchers. A more profound investigation into the underlying dynamics and an expansive inquiry into associated elements could provide further clarity regarding the intricate interplay among environmental commitment, green packaging, and financial efficacy.

6.2 Theoretical Implications

The present study aims to delineate a vital connection existing between green packaging and the revenue growth

observed in manufacturing firms. As such, this research contributes to a broader examination of the dynamics between green packaging and revenue growth, furthering the discourse in this field. In addition, by scrutinizing the moderating influence of environmental commitment on the association between green packaging and the revenue growth of manufacturing companies, this work meaningfully enhances existing scholarly literature.

In order to ensure that the investigation retains relevance and authenticity within the specified context, the recalibrated measurement of latent variables employed in the study is crucial. This recalibration is anticipated to yield a more nuanced comprehension of the interactions between the various constructs under consideration, thus providing valuable insights.

Moreover, the conceptual framework that addresses the moderating role of environmental commitment within the context of the green packaging and revenue growth nexus presents a novel avenue for academic exploration aimed at deepening understanding regarding revenue growth, while simultaneously enabling manufacturing entities to implement green packaging approaches to bolster their competitiveness.

The theoretical structure known as the Resource-Based View posits that distinctive resources such as green packaging is integral to obtaining competitive advantage. Yet, the observation that environmental commitment does not play a significant moderating role in this relationship underscores that mere adherence to sustainability principles does not suffice. Enterprises are necessitated to strategically assimilate and harness green packaging innovations to fortify their competitive stance and enhance revenue growth, with a pivotal focus on effective implementation and resource alignment.

Dynamic Capability theory underscores the necessity for firms to recalibrate their resources in alignment with market fluctuations. The observation regarding the insignificance of environmental commitment in moderating the relationship between green packaging and revenue growth indicates that dynamic capabilities occupy a central position in this context. Corporations must cultivate innovation management, market responsiveness, and operational adaptability to proficiently capitalize on green packaging initiatives. Hence, dynamic capabilities prove to be paramount for transforming green packaging innovations into augmented revenue growth.

Additionally, Signal theory examines the implications of green packaging as a marker of environmental responsibility. The indication that environmental commitment does not notably bolster the relationship between green packaging and revenue growth implies that while green packaging serves as an assertion of dedication, its revenue-generating effects are not substantially influenced by the level of commitment exhibited by the firm. Instead, the efficacy of green packaging appears to hinge more on its perceived credibility and quality rather than solely on the entity's professed commitment to environmental sustainability.

6.3 Managerial Implications

The findings of this analysis have a lot of implications:

It is imperative for managers to comprehend that the mere declaration of environmental commitment does not markedly enhance the revenue growth stemming from green packaging initiatives. In order to realize optimal revenue outcomes, enterprises must judiciously intertwine green packaging initiatives with overarching business strategies encompassing marketing, operational mechanisms, and consumer engagement. A comprehensive methodology that correlates green packaging with fundamental business operations and value propositions is crucial for unlocking revenue potential and fostering significant growth.

The efficacy of green packaging as a catalyst for revenue escalation hinges more critically on its inherent quality and the credibility it wields, rather than the corporate environmental assertions. Consequently, managers must prioritize the fabrication of superior, innovative green packaging that conforms to environmental stipulations whilst simultaneously captivating consumer proclivities. Allocating resources towards research and development to refine aspects such as design, functionality, and visual appeal has the potential to engage consumer interest and catalyze sales.

Given that the mere environmental commitment does not exponentially fortify the relationship between green packaging and revenue expansion, managerial focus should pivot towards cultivating dynamic capabilities such as innovation management, market adaptability, and operational agility. Such capabilities are indispensable for enterprises to acclimatize to market fluctuations, effectively synchronizing green packaging strategies with the continuously transforming demands of consumers, thus enhancing the influence of green packaging on revenue growth.

It is also essential for managers to acknowledge that the signaling effect of green packaging is not significantly magnified by the organization's environmental commitment. Instead, emphasis should be directed towards the demonstrable benefits and quality intrinsic to the green packaging itself. Strategic marketing initiatives should accentuate the distinctive attributes and advantages of the packaging, ensuring alignment with consumer sentiments, differentiation within the market, and enhancement of the brand's allure, thereby facilitating revenue growth.

Lastly, managers should adopt an enduring viewpoint concerning green packaging undertakings. Although immediate revenue consequences may appear minimal, investments in green packaging can lead to notable long-term

gains, inclusive of enhanced brand standing, increased customer allegiance, and adherence to shifting regulatory frameworks. Formulating a thorough, long-term strategy that integrates green packaging within the context of the organization's sustainability objectives and broader business aims is instrumental in achieving sustained revenue increments and maintaining a competitive edge.

6.4 Limitations and Recommendations for Future Research

The emphasis of the investigation on manufacturing enterprises located within the geographical confines of Ghana could potentially restrict the extrapolation of the results to alternative geographical locales or sectors of industry. It is plausible that the economic, cultural, and legalistic elements inherent to Ghana could uniquely modulate the interaction between green packaging and revenue expansion. Consequently, forthcoming inquiries ought to delve into this specific interaction across diverse regions and industrial sectors in order to elucidate how varying contextual factors might influence the efficacy associated with green packaging initiatives.

Additionally, it is conceivable that the present investigation predominantly captured the immediate repercussions of green packaging on revenue increments. The advantages of such initiatives may not manifest in a timely fashion, necessitating an extended temporal framework to thoroughly evaluate their influences. Prospective studies should adopt longitudinal methodologies that facilitate the monitoring of modifications over protracted durations, thereby offering perspectives on the evolution and realization of benefits attributed to green packaging.

Variability in environmental commitment levels among firms could significantly affect both the execution and perception of green packaging strategies, a nuance that may not have been fully acknowledged in the present study. It is imperative for future investigations to scrutinize the relationship between disparate levels of environmental commitment and the resultant outcomes of green packaging practices. Engaging in detailed segmentation analysis could yield heightened clarity regarding the relationship between varying commitment intensities and the success of green packaging innovations.

Furthermore, evaluating the moderating effect of environmental commitment presents substantial complexities and is inherently subjective, which may have repercussions on the findings as elucidated. Subsequent studies should implement a more intricate array of evaluative measures, including qualitative evaluations, case study methodologies, and the employment of comprehensive multi-dimensional scales, to better capture the intricate interactions correlating environmental commitment with the efficacy of green packaging. Such methodological enhancements would illuminate the complexities embedded in the interrelationship among these variables.

Lastly, the influence exerted by green packaging on revenue growth could be moderated by consumer perceptions and behaviors, an area that may warrant further exploration. Future research endeavors should prioritize a deeper understanding of consumer attitudes and preferences pertinent to green packaging. An examination of the response patterns among differing consumer demographics to green packaging and its subsequent impact on purchasing behaviors could elucidate invaluable insights regarding its effect on revenue trajectories.

Author Contributions

Conceptualization, D.N.A. and J.K.A.; methodology, J.K.A. and E.A.K.; software, D.N.A. and I.K.A.-A.; validation, J.K.A., E.A.K., I.K.A.-A., and D.N.A.; formal analysis, D.N.A. and I.K.A.-A.; investigation, E.A.K. and J.K.A.; resources, I.K.A.-A. and E.A.K.; data curation, J.K.A. and E.A.K.; writing—original draft preparation, D.N.A. and J.K.A.; writing—review and editing, D.N.A. and E.A.K.; visualization, J.K.A. and I.K.A.-A.; supervision, D.N.A.; project administration, J.K.A. All authors have read and agreed to the published version of the manuscript.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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