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Top Management Environmental Concern, Eco-Product Development Effectiveness and Firms' Environmental Performance: The Paradoxical Moderating Role of Environmental Information Sharing

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ABSTRACT

This study investigates the combined effect of top management environmental concern and eco-product development effectiveness on firms' environmental performance. The study also considers the moderating impact of environmental information sharing on this process. Building on the integration of upper echelons perspective and resource-based theory, the research model was tested using covariance-based structural equation modelling with survey data from 171 small and medium-sized technology firms operating in Nigeria. The findings show that top management environmental concern facilitates eco-product development effectiveness, which in turn positively influences firms' environmental performance. Additionally, the findings indicate that environmental information sharing strengthens top management environmental concern but weakens the impact of eco-product development effectiveness on environmental performance. These results contribute to extant literature by unpacking the boundary conditions through which the interplay of top management environmental concern and eco-product development effectiveness can promote environmental performance within emerging market firms. For practitioners, the study generates valuable insights into how environmental information sharing can amplify or attenuate their environmental initiatives and performance outcomes.

1 | Introduction

Recently, there has been a rising discourse on issues of climate change, environmental pollution and the regulatory requirements for emerging market firms to enhance environmental protection (Le and Zhang 2025; Roh et al. 2022; Zhong et al. 2025). This has driven the top management of small and medium-sized firms (SMEs) to incorporate environmental initiatives into their firms' strategic actions to meet expectations of key stakeholders, foster environmental sustainability and

enable a safe environmentally friendly future (Jiang et al. 2025; Sègbotangni et al. 2025). A growing number of previous studies indicate that the pursuit of environmental sustainability by firms has brought the concept of 'top management environmental concern' to the attention of academics, policymakers and practitioners (Le and Govindan 2024; Mo et al. 2022). In this study, top management environmental concern refers to the extent to which top management prioritises and integrates environmental initiatives into their firm's operational processes (Makhloufi et al. 2022; Sherazi et al. 2025). It enables

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top management to develop a positive behaviour towards environmental practices, pursue environmental initiatives, share informational resources and invest in eco-innovation research and development (R&D) (Huang et al. 2025; Tang et al. 2024). This aligns with the upper echelons theory (Hambrick 2016) notion that top management attributes and values regarding environmental issues are central to firms' pursuit of environmental protection and environmental objectives (Adusei et al. 2025; Mahran and Elamer 2024).

Despite recent scholarly efforts on top management environmental concern (Makhloufi et al. 2022; Sherazi et al. 2025), three notable gaps persist in the environmental management literature. Firstly, past empirical evidence on top management environmental concern primarily focuses on large firms and originates from Western and Asian economies, thereby overlooking smaller firms and emerging economies in other parts of the global natural environment (Le and Govindan 2024; Munawar et al. 2022). This offers an incomplete picture of the top management environmental concern phenomenon and has led to repeated scholarly calls on the need for contextualisation of environmental management research towards emerging markets (Mahran and Elamer 2024; Xie et al. 2024). Accordingly, this suggests a limited understanding of 'how' and 'when' top management concern can generate favourable environmental performance in SMEs within emerging markets.

Second, while top management environmental concern is crucial for implementing environmental management practices (Madrid-Guijarro and Duréndez 2024; Makhloufi et al. 2022), past research indicates a lack of theoretical precision regarding the mechanisms that can explicate how top management environmental concern relates to environmental performance (Le and Govindan 2024). From a resource-based theory lens (Barney et al. 2021), we know that many firms competently engage in eco-product development by integrating environmental considerations into product offerings to enhance their competitive market position and minimise environmental damages (Sahoo et al. 2024; Rabal Conesa et al. 2025). However, empirical research is scant on how eco-product development effectiveness can serve as an important conduit for leveraging top management environmental concern to bolster environmental performance (cf. Mahran and Elamer 2024). Such a knowledge gap hampers the theoretical understanding of how top managers can justify investment in eco-product development, especially in emerging markets where firms are heavily resource-constrained (cf. Abid et al. 2024).

Third, little attention has been paid to the contextual factors that shape how top management environmental concern influences environmental performance (Mo et al. 2022). Due to the context-dependent nature of firms' environmental practices (Sègbotangni et al. 2025), environmentally concerned top management engage in external relations with key partners to exchange information to boost their environmental initiatives (Agyabeng-Mensah et al. 2024). Nonetheless, empirical efforts to investigate environmental information sharing as a boundary condition of how top management environmental concern and eco-product development effectiveness work in concert to influence environmental performance remains under-researched in the extant literature.

In light of the knowledge gaps above, this study builds on integrative insights from the upper echelons theory (Hambrick 2016) and resource-based theory (Barney et al. 2021), which argue that the intersection of top management attributes and firms' competencies determine the performance outcomes of firms (Hashim et al. 2026; Yang and Entebang 2025). Based on this line of reasoning, this study seeks to examine the effect of top management environmental concern on eco-product development effectiveness and SMEs' environmental performance under the moderating impact of environmental information sharing. Thus, this study focuses on three research questions.

Research Question 1. Does eco-product development effectiveness intervene in the effect of top management environmental concern on environmental performance?

Research Question 2. How do differing conditions of environmental information sharing moderate the relationship between top management environmental concern and environmental performance?

Research Question 3. How do differing conditions of environmental information sharing moderate the relationship between eco-product development effectiveness and environmental performance?

To answer these questions, this study collects primary survey data from 171 technology-focused firms operating in the Nigerian SMEs sector. In Nigeria (an emerging economy in Africa), SMEs account for 96% of all businesses, and their environmental practices are vital to reducing pollution and protecting the natural environment (PwC Nigeria 2024; Adesua-Lincoln 2025). Consequently, this study contributes to the environmental management literature in three important ways.

First, despite research on the environmental consequences of top management attributes (Jiang et al. 2025; Madrid-Guijarro and Duréndez 2024), past research has scarcely considered the association between top management environmental concern and eco-product development effectiveness. Thus, this study contributes to the upper echelons research (Huang et al. 2025; Tang et al. 2024) by highlighting the role of top management environmental concern in influencing eco-product development effectiveness. This extends the current literature and enhances the business case for top management environmental concern in emerging markets.

Second, by examining the mediating effect of eco-product development effectiveness, the study provides empirical evidence for eco-product development effectiveness as an underlying mechanism in the linkage between top management environmental concern and environmental performance. This adds to literature on the integration of upper echelons perspective and resource-based theory (Hashim et al. 2026) and contributes to debates on the drivers of environmental performance (Roh et al. 2022; Zhong et al. 2025) by foregrounding the value of top management environmental concern and eco-product development effectiveness on SMEs' environmental performance.

Third, this study advances existing research by demonstrating how top management environmental concern, when

complemented with environmental information sharing, can strengthen environmental performance. Also, the study finds that environmental information sharing attenuates the effect of eco-product development effectiveness on environmental performance. Hence, this study adds to the resource-based perspective in environmental management (Asiaei et al. 2022; Sahoo et al. 2023) by shedding light on the boundary conditions in which environmental performance can be improved in firms. Overall, the study findings add to the environmental management domain by integrating the upper echelons and resource-based theories to offer a nuanced perspective on the dynamics of top management environmental concern, eco-product development effectiveness, and environmental performance in emerging markets firms.

Following this introduction, the rest of this article is organised as follows. Section 2 presents the theory and hypotheses. Section 3 outlines the research methods, while Section 4 presents the data analysis and reports the empirical results. The final section, Section 5, discusses the findings, research implications and future research suggestions.

2 | Theory and Hypotheses Development

2.1 | Theoretical Underpinning

Since a single theory may not be enough to explain firm's environmental initiatives and performance (Mahran and Elamer 2024), this study builds on the integration of upper echelons and resource-based theories to explain the proposed conceptual framework. The upper echelons theory (Hambrick 2016; Hambrick and Mason 1984) proposes that the behaviours, values and perspectives of top management are key elements that shape the strategies and performance outcomes of firms. The theory posits that top managers possess divergent values and perspectives, which influence their selective perception and concern for their firms' environmental activities (Arena et al. 2018; Le and Zhang 2025). The upper echelons theory has evolved considerably since its original formulation (Hambrick 2016). Recent advancements has extended the theory beyond observable top managers' demographic proxies (e.g., age, tenure and functional background) to encompass top management's values and behaviours as core theoretical elements shaping strategic choices and organisational outcomes (Neely et al. 2020; Liu et al. 2025; Yue and Bajuri 2026) including environmental performance (Hu et al. 2024).

Within the upper echelons theory literature (Tang et al. 2024), extant research indicates that firms' top management possesses different views on environmental protection and may exhibit varying degrees of concern on environmental issues, ultimately shaping the environmental strategic choices and performance of their firms (Mahran and Elamer 2024; Shahab et al. 2020). Top management environmental concern reflects top managers' strategic priority for implementing environmental initiatives into their organisational processes (Munawar et al. 2022; Qi et al. 2010). In this sense, top management environmental concern can be viewed as an important factor that guides a

firm's careful approach to proactive environmental sustainability practices (Makhoulfi et al. 2022). Prior literature suggests this can influence firms' environmental management practices including eco-innovation strategies and dedication to environmental conservation (Li et al. 2023; Ullah et al. 2024).

Moreover, the resource-based theory suggests that firms' resources and competencies are central to the attainment of superior organisational performance (Barney et al. 2021; Coates and McDermott 2002). The resource-based theory has also been adopted in the environmental management research to explain how firms can drive environmental performance (Sahoo et al. 2023; Zahoor and Gerged 2021). From a resource-based theory perspective, past research also highlights that firms' competencies manifest from the values and behaviours of the top management (Adusei et al. 2025; Devine et al. 2019; Haldorai et al. 2022). Thus, this study argues that top management environmental concern could serve as a precursor to eco-product development effectiveness. In this study, eco-product development effectiveness reflects a firm competency to integrate environmental considerations into its product development process by creating new eco-products and enhancing current ones to effectively meet stakeholders' expectations (Charter et al. 2017; Katsikeas et al. 2016). From a resource-based theory lens (Coates and McDermott 2002), such a competency is crucial for attaining market success, minimising environmental risks and promoting environmental goals (Carchano et al. 2024).

Besides, since firms require information to deal with uncertainty, strengthen knowledge of environmental issues and pursue environmental objectives (Sahoo et al. 2023), the competency to engage in sharing of environmental information with other key external partners in their industry becomes paramount (cf. Chavez et al. 2021; Wu 2008). As such, environmental information sharing is considered an intangible resource as it provides firms the ability to access new knowledge outside its boundaries for supporting their environmental sustainability activities (Agyabeng-Mensah et al. 2024). From a resource-based lens, this allows firms to learn and respond to environmental disruptions (Amit and Schoemaker 1993). Extant literature indicates that environmental information sharing is a vital organisational routine that supports firms in undertaking environmental practices and abiding by environmental regulations (Lai et al. 2015). In this study, environmental information sharing is positioned as a firm-level contextual condition that can shape the efficacy of top management environmental concern in facilitating environmental benefits to firms.

Building on the above argument, this study, therefore, combines the complementary perspectives of upper echelons theory and the resource-based logic to develop a conceptual framework (see Figure 1) that hypothesises the relationship between top management environmental concern and environmental performance, and the mediating impact of eco-product development effectiveness on this linkage. In addition, the study considers the contingent effect of environmental information sharing on the interplay of top management environmental concern and eco-product development effectiveness on SMEs' environmental performance.

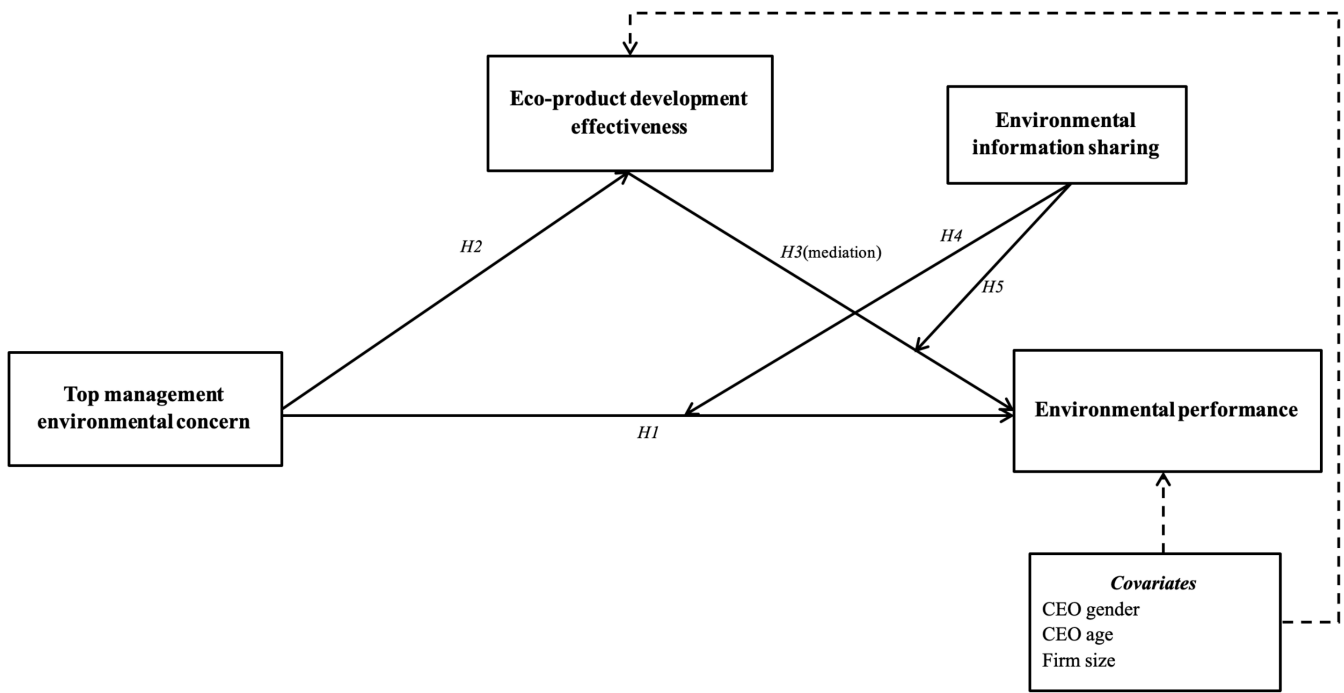


FIGURE 1 | Conceptualised model. *Source:* Authors' own construction.

2.2 | Hypotheses

2.2.1 | Top Management Environmental Concern and Environmental Performance

Top management environmental concern refers to the extent to which top managers prioritise and implement environmental initiatives into a firm's operational processes (Munawar et al. 2022). This includes their commitment to environmental protection, their environmental values, and motivation to address environmental challenges within the business (Le and Govindan 2024; Qi et al. 2010). This aligns with the logic of upper echelons theory, which holds that top management's perception and behaviour shape the strategic imperatives of firms (Hambrick 2016). On the other hand, environmental performance represents firms' assessment of their success in implementing environmental practices and meeting stakeholders' expectations regarding the protection of the natural environment (Dubey 2025; Chen et al. 2015). In this regard, top management could play a significant role in adopting and implementing environmental strategies that create strategic value and serve as guidance to firms' environmental actions (Tang et al. 2024). Thus, in view of the upper echelons' perspective, this study contends that top management environmental concern would be positively linked to environmental performance.

Further, a firm's strategy is usually grounded in decisions made by top management, and their disposition towards environmental concern guides the environmental practice of firms (Sherazi et al. 2025; Yue et al. 2026). Hence, top management can incorporate environmental initiatives as a vital component of a firm's strategy (Qi et al. 2010; Xie et al. 2024). This can assist firms in pursuing environmental collaboration, complying with

environmental regulatory standards, and adopting proactive environmental management practices to reduce negative ecological impacts and minimise waste (Mahran and Elamer 2024; Makhloufi et al. 2022).

Additionally, the extant literature indicates that top managers' commitment to environmental concerns is influential in driving environmental sustainability practices within firms (Haldorai et al. 2022). For instance, they could do this by championing environmental innovations, committing resources to sustainability initiatives, and creating an organisational culture that support environmental responsibility (Le and Govindan 2024; Ullah et al. 2024). This can also strengthen employees and stakeholders' interest in actively participating in goals that promote environmental performance (Albrecht et al. 2024; Agyabeng-Mensah et al. 2024).

Moreover, given that proponents of the upper echelons theory denote that top management are responsible for the environmental activities of firms (Adusei et al. 2025; Tang et al. 2024), top managers with higher environmental concern will view environmental issues as strategically important; they can swiftly recognise the environmental consequences of their firms' activities and allocate resources towards environmental initiatives to combat them (Ren et al. 2022). Also, when SME leaders prioritise environmental protection, they can implement environmental practices quickly without navigating the bureaucratic structures found in larger organisations to achieve their environmental sustainability goals (Zacher et al. 2024). Based on the arguments above, this study hypothesises that:

Hypothesis 1. *Top management environmental concern is positively related to environmental performance.*

2.2.2 | Top Management Environmental Concern and Eco-Product Development Effectiveness

Eco-product development effectiveness describes a firm's capacity to integrate environmental considerations into its product development process by creating new eco-products and enhancing current ones to effectively meet stakeholders' expectations (Charter et al. 2017; Katsikeas et al. 2016). Extant literature emphasises that eco-product development effectiveness can ensure firms develop products that incorporate environmental attributes, meet stakeholders' environmental expectations and achieve commercial viability (Carchano et al. 2024; Sahili and Barrales-Molina 2024). Thus, an effective eco-product development requires firms to embed environmental considerations into product design, technological processes, and lifecycle assessment while maintaining competitive advantage (Song and Du 2024; Yue et al. 2026).

Building on the upper echelons perspective (Hambrick 2016), environmentally conscious top managers are more likely to allocate supportive resources to eco-innovation practices and the implementation of eco-product development initiatives within their firms (cf. Arena et al. 2018). Hence, this study anticipates that top management environmental concern will positively associate with eco-product development effectiveness. This is based on three reasons. First, past research indicates that when top management champions eco-product innovations, these initiatives receive better resource allocation and organisational-wide support (Adusei et al. 2025; Makhoulfi et al. 2022). This can help the firm adopt eco-friendly processes and showcase a strong commitment to environmental protection (Ullah et al. 2024). In this way, eco-product development effectiveness can become a key priority for the firm (Katsikeas et al. 2016). Supporting this view, Roh et al. (2022) demonstrate that managerial-driven environmental initiatives are a powerful antecedent for promoting green product innovation outcomes in firms.

Second, top management's display of strong environmental concern can enable conducive conditions that facilitate environmental problem-solving in the firm (Li et al. 2023). In this regard, when top managers visibly prioritise environmental considerations, employees feel encouraged to invest effort in pro-environmental behaviours and exploring eco-product development opportunities rather than viewing such work as secondary to core business (Albrecht et al. 2024). This can aid in renewing and broadening green knowledge stock that is crucial to the deployment of eco-innovation methodologies in the firm (Sahoo et al. 2023), and in the process facilitate stronger eco-product development effectiveness.

Further, top management with high environmental concern tend to engage stakeholders in the eco-product development process. They actively involve customers, suppliers, and regulatory bodies in their eco-product development processes (Li et al. 2023). This allows the firm to assimilate better market intelligence on regulatory guidelines and environmental stakeholders' expectations. Ultimately, this can help bridge the eco-innovation process and eco-product market fit of firms, thereby enabling the enhancement of eco-product development effectiveness (Adomako and Tran 2024).

Put together, the above arguments and insights from the upper echelons theory suggest that top management environmental concern might serve as an impetus for eco-product development effectiveness in firms. So, this study predicts that:

Hypothesis 2. *Top management environmental concern is positively related to eco-product development effectiveness.*

2.2.3 | Indirect Effect of Eco-Product Development Effectiveness

In addition to predicting the possible link between top management environmental concern and environmental performance, this study further investigates the mediating effect of eco-product development effectiveness in this linkage. Past literature has emphasised the need for research examining the intervening mechanisms that might explain how top management environmental concern yields environmental benefits for firms (Makhoulfi et al. 2022; Sherazi et al. 2025). This study responds to this call by synthesising the upper echelons and resource-based theories (Hu et al. 2024) to contend that eco-product development effectiveness as a firm competency plays an indirect role in the linkage between top management environmental concern and environmental performance.

Within this context, a successful eco-product development effectiveness can help firms to improve their eco-product quality, minimise pollution, engage in waste recycling, reduce carbon footprint and enhance their competitive advantage (Sahili and Barrales-Molina 2024; Sahoo et al. 2024). Based on the resource-based perspective, this can assist in mitigating adverse ecological footprint and legitimising increased investment in environmental initiatives, thereby supporting the attainment of environmental objectives in the firm (Adomako and Tran 2024; Yue et al. 2026). Moreover, top management devotion to environmental initiatives can strengthen the eco-product development competencies of firms relating to technical expertise, design technologies, and development of better greener products (Sahoo et al. 2024). From a resource-based theory lens (Barney et al. 2021), such competencies can support and extend firms' environmental sustainability practices and offer another route for meeting their environmental performance targets (Adusei et al. 2025; Olaleye 2023).

Furthermore, extant literature indicates that environmentally concerned top managers are more inclined to pursue design-integrated eco-product development that supports environmental success rather than engaging in superficial greenwashing (Katsikeas et al. 2016). This can build robust eco-product development effectiveness, thereby supporting an organisational culture that values environmental protection (Carchano et al. 2024). This could help firms to deliver genuine environmental benefits that meet regulatory compliance, reduce stakeholders' pressure and signal that the firm is committed to environmental sustainability. As such, firms' employees may develop a sense of being environmentally responsible and commit to pro-environmental behaviours that strengthen environmental performance (Haldorai et al. 2022; Ren et al. 2022).

Consequently, combining the upper echelons and resource-based theories logic (Yang and Entebang 2025), this implies that eco-product development effectiveness serves as a bridging competency that could enable firms to convert the potential in top management environmental concern into tangible environmental performance gains. This reinforces prior literature's argument that improved environmental performance may be largely dependent on top management who are both committed to environmental initiatives and are able to maximise firms' competencies (Haldorai et al. 2022). From the foregoing, this study contends that top management environmental concern might not sufficiently influence environmental performance without the intervening mechanism of eco-product development effectiveness. Thus, this study expects that:

Hypothesis 3. *Eco-product development effectiveness mediates the relationship between top management environmental concern and environmental performance.*

2.2.4 | Moderating Effect of Environmental Information Sharing

While top management environmental concern may affect firms' environmental performance, the broader context is likely to shape this relationship. This aligns with past research indicating that contextual conditions shape firms' environmental activities (Arena et al. 2018; Tang et al. 2024). This study, therefore, introduces environmental information sharing as a boundary condition that can influence the predicted relationship between top management environmental concern and environmental performance. Drawing on extant literature, environmental information sharing describes the degree to which a firm engages in mutual exchange of environmental-related information about its environmental practices with its key external partners (Lai et al. 2015; Wu 2008). From a resource-based perspective, firms need high-quality environmental information to strengthen their green intellectual capital, address environmental issues, and comply with environmental regulations (Haldorai et al. 2022; Sahoo et al. 2023). Hence, firms engage in information sharing routines on environmental practices with key partners such as suppliers and customers to receive valuable feedback and bolster efficiency in their environmental sustainability practices (Chavez et al. 2021). As such, environmental information sharing can help reduce top management environmental information asymmetry and provide them with the necessary informational resources to explore environmental initiatives that can minimise environmental damage and green their operational processes (Agyabeng-Mensah et al. 2024). This can aid firms' environmental protection programmes, thereby leading to improved environmental performance.

Also, by engaging in environmental information sharing routines, top management can assimilate external information about green raw materials and latest developments in environmental technology (Sahoo et al. 2023). This can support firms in adopting circular initiatives and green technology that promotes zero waste (Li et al. 2023; Wong 2013). Thus, it provides room for boosting firms' environmental performance

objectives. Further, when high environmental information sharing is prevalent, top management is motivated to take initiatives that respond to eco-pressures from external stakeholders and meet the requirements of environmental regulators (Lai et al. 2015). This can assist in standardising and integrating a shared sense of environmental protection with key partners, which is crucial for promoting a culture of environmentalism within the firm, minimising environmental impacts and promoting recyclability of their eco-products (Agyabeng-Mensah et al. 2024).

Considering the above arguments, this study argues that when top management environmental concern is complemented with high levels of environmental information sharing, it is more likely to boost firms' environmental performance. Therefore, it is formulated that:

Hypothesis 4. *Environmental information sharing will positively moderate the relationship between top management environmental concern and environmental performance.*

Conversely, this study also argues that environmental information sharing could attenuate the linkage between eco-product development effectiveness and firms' environmental performance. To start with, the development of eco-products necessitates the sourcing of external environmental information to support eco-product design, build green knowledge and reduce environmental risks (Sahoo et al. 2023; Lai et al. 2015). However, engaging in environmental information sharing could also engender a situation where excessive environmental information exchange may lead to mixed insights that introduce 'noise' into firms' eco-product development process due to the lack of within-field specialised knowledge provided by external partners (cf. Chavez et al. 2021). In this context, low levels (rather than high levels) of environmental information sharing may be more beneficial for firms' eco-product development effectiveness.

Moreover, reflecting on the resource-based theory in the context of emerging markets, firms are usually resource-constrained and face challenges in mobilising organisational resources (Abid et al. 2024). Thus, engaging in environmental information-sharing routines could be costly due to the time and resources required to build relationships and interact with external partners. This can drain and spread scarce resources thin, thereby detracting firms from investing significantly in their core innovation technology (Opata and Akuoko 2025). Accordingly, this could dampen the association between eco-product development effectiveness and firms' environmental performance. Besides, while a high level of environmental information sharing supports the integration of environmentally related knowledge within firms (Agyabeng-Mensah et al. 2024), firms may view it as a substitute for actively participating in R&D on eco-products to reduce costs (cf. Wong et al. 2020). In such a situation, eco-product development effectiveness may become less potent in driving environmental objectives.

Following the logic of the arguments above, this study anticipates that the relationship between eco-product development effectiveness and environmental performance will weaken as environmental information sharing increases. Hence, this study proposes that:

Hypothesis 5. *Environmental information sharing will negatively moderate the relationship between eco-product development effectiveness and environmental performance.*

Figure 1 presents the hypothesised model of the study.

3 | Methodology

3.1 | Empirical Context

This study follows a quantitative methodology, and the empirical setting is firms operating in the Nigerian SMEs sector. Nigeria offers a compelling setting because its economy is heavily reliant on SMEs, which make up 96% of all businesses in the country (PwC Nigeria 2024). In particular, this study focuses on technology-focused firms whose activities involve offering technology-related products that can have considerable environmental implications (Ko and Liu 2017). Therefore, due to environmental risks and societal expectations in Nigeria, these technology firms are encouraged to adopt eco-friendly practices and adhere to environmental sustainability guidelines established by regulatory bodies such as the National Environmental Standards and Regulations Enforcement Agency (NESREA) (Adesua-Lincoln 2025; Enajero 2025). Further, Nigeria recently implemented a Climate Change Act that mandates firms to appoint an Environmental Sustainability Officer and to produce annual sustainability reports to promote environmental practices (Ladan 2022). Thus, Nigeria represents a unique context for the study.

3.2 | Sampling and Data

As part of a larger research project on responsible innovation in SMEs, this study used a primary survey to collect new data to test the formulated hypotheses. Following a review of literature, measures for evaluating the variables were derived from extant literature and adapted to address the research questions. Next, a structured questionnaire was designed and underwent a preliminary test through informal discussions with both industry practitioners and academic experts ($n = 13$). Based on the consultation, some questionnaire items were refined to ensure face validity and contextual relevance to the empirical setting (Huang et al. 2025). This ensured that the finalised questionnaire was ready for distribution.

The sampling frame for this study was the Nigerian Business Directory, a comprehensive database of formally registered businesses operating across Nigeria. From this sampling frame, 500 technology firms were selected using purposive sampling. Purposive sampling was adopted to ensure the operational activities of the selected firms had ecological impact and to access firms with specialised knowledge of the research phenomenon (Adusei et al. 2025; Larabi 2026). This approach ensures that the sampled firms were theoretically and contextually relevant to the research questions. These selected firms met the sampling criteria of (1) being privately owned businesses, (2) offering technology-related products to the market, and (3) employing not more than 199 full-time employees, ensuring they meet the definition of SMEs in Nigeria (Small and Medium Enterprises

Development Agency of Nigeria [SMEDAN] 2025). A research team comprising two of the authors and three trained research assistants contacted eligible firms via electronic communication and in-person visitation. During initial contact, the research purpose was explained to firm representatives, and their verbal permission was sought for data collection. To ensure ethical standards, the questionnaire was reviewed by the first author's department, and all participants were briefed on the research objectives, procedures, the anonymity of their responses and their rights as research participants. Also, the participants provided written informed consent before completing the questionnaire.

To ensure that the most knowledgeable participants in the firms responded to each construct, a dyadic data collection involving senior executives (i.e., owners/chief executive officers [CEOs] and managers), was implemented (Adomako et al. 2021). Using on-site survey administration, the research team collected data on the control and independent variables (i.e., top management environmental concern, eco-product development effectiveness and environmental information sharing) from CEOs/owners of the firms. This is due to these constructs reflecting strategic priorities that fall under the task of the CEO/owners. Whereas general managers were asked to provide data on the dependent variable, environmental performance, since their role gives them operational oversight on firm's performance outcomes (Adomako et al. 2021). An identifier code was used during the survey to enable accurate pairing of responses during data processing. Importantly, the use of two respondents per firm (multi-respondent strategy) is a well-established procedure for remedying method bias and collecting high-quality, reliable data in firm-level focused surveys (Adomako et al. 2021; MacKenzie and Podsakoff 2012; Zhou et al. 2019). To verify the authenticity of responses, only senior executives with confirmed operational responsibility in their respective firms were recruited. In addition, all returned questionnaires following the fieldwork were systematically screened for response validity. Questionnaires were flagged and removed if they exhibited: (a) incomplete responses, (b) straight-lining patterns, whereby a respondent selected the same scale point across all items; or (c) implausible response combinations that suggested inattentive answering. Applying these criteria, four questionnaires were removed from the 175 responses received. Thus, 171 usable dyadic responses (i.e., 34.2% response rate) were obtained.

Further, an a priori sample size sufficiency test was conducted via power analysis using the *WebPower* R package (version 0.9.4; Zhang and Mai 2023) with medium effect size = 0.15, alpha = 0.05, power = 0.90 and six predictors (including covariates). The required minimum sample size was 123 firms. This is below the final sample of 171, indicating that the study possesses sufficient statistical power for hypotheses testing. Of these 171 firms, 36.3% had female CEOs while 63.7% had male CEOs. Table 1 contains the sample profile.

3.3 | Variable Measurement

The questionnaire was designed using multi-item perceptual scales that are derived and modified from existing validated subjective measures to account for the empirical context of the study. All multi-item measures were evaluated using a seven-point

TABLE 1 | Sample profile.

	Percent
<i>CEO gender</i>	
Female	36.3
Male	63.7
<i>CEO age (years)</i>	
Below 30	17.5
31–35	31.0
36–40	16.4
Above 40	35.1
<i>Firm size (employees)</i>	
Below 10	10.9
10–20	19.0
21–30	7.6
Above 30	49.1

Likert rating (see Table 2 for measurement details). Although subjective measures are vulnerable to bias, the reliance on subjective perceptual scales is consistent with established practice in environmental management research, where there is a strong quality of validated studies examining managerial perceptions and performance outcomes with self-reported surveys (Adusei et al. 2025; Cuevas-Lizama and Royo-Vela 2026). Furthermore, the absence of publicly available objective proxy data in Nigeria for the variables of interest makes perceptual measures the most feasible and methodologically appropriate option in this context (Dubey 2025; Jordan et al. 2025).

On the basis of reviewing past studies relating to managerial environmental concern, complemented with judgement from preliminary discussions with 10 industry practitioners and three academic experts to ensure item relevance and fit to the empirical context, we derived the measure of top management environmental concern with a developed four-item scale based on insights from extant research (Munawar et al. 2022; Qi et al. 2010). The items helped to capture the extent of top management's concern for environmental initiatives of their firms (Le and Govindan 2024). Also, results from an exploratory factor analysis applying maximum likelihood revealed that the four-item scale is a unidimensional factor, with item loadings above 0.750. The coefficient alpha for the measure is 0.876.

Eco-product development effectiveness was measured with three adapted items taken from Katsikeas et al. (2016) scale on product development effectiveness. The adapted three-item measure captured the extent to which a firm has been competent in its eco-product development effectiveness. Preliminary discussions with industry and academic experts supported the appropriateness of the scale and established content validity (Hair et al. 2019). The coefficient alpha for the measure is 0.948.

Environmental information sharing was assessed with a four-item modified scale from past research (Wu 2008). The items

TABLE 2 | Measurement.

	Loadings
<i>Top management environmental concern^a</i>	
Environmental initiatives are an important component of our firm's strategy.	0.814
Managers perceive our environmental innovation routines as worthwhile.	0.858
Environmental initiatives are necessary for improving our environmental activities.	0.768
Managers pay considerable attention to 'environmental' issues in our innovation process.	0.766
<i>Eco-product development effectiveness^b</i>	
The rate of our new individual eco-product introductions in the market has improved.	0.928
The rate of our new individual eco-product quality improvement has grown.	0.920
Our new individual eco-products' success rate has improved.	0.932
<i>Environmental information sharing^a</i>	
Our partners always provide us with environmental information.	0.741
We rely on our partners for environmental information.	—
Our partners should be willing to share environmental information.	0.745
We always obtain timely environmental information from our partners.	0.682
<i>Environmental performance^b</i>	
We comply with environmental regulations.	0.810
We prevent and mitigate environmental crises.	0.870
We educate our employees and the public about the environment.	0.797

Note: —Dropped due to loading below 0.650 threshold.

^a1 = 'Strongly disagree' to 7 = 'Strongly agree'.

^b1 = 'Extremely poor' to 7 = 'Excellent'.

evaluated whether firms mutually exchange relevant environmental information with their partners. The coefficient alpha for the measure is 0.768.

Environmental performance, the dependent variable, was measured with three subjective items derived from adapting an existing environmental performance scale in previous research (Chen et al. 2015; Judge and Douglas 1998). The measure subjectively captured the extent to which firms have achieved their environmental objectives in the past 2 years. The operationalisation of environmental performance using a perceptual instrument is consistent with past studies in environmental management research (Asiaei et al. 2023; Chen et al. 2015). The coefficient alpha for the measure is 0.864.

The study also included CEO gender, age and firm size as control variables since these might influence firms' environmental actions. CEO gender (male = 0, female = 1) and age (the years of the CEO) were controlled for as these variables might affect the environmental decision-making process of senior executives. Firm size (the log-transformed number of employees in the firm) was controlled for because larger firms may enjoy resource-based advantage in comparison to their smaller counterparts (Arena et al. 2018).

3.4 | Common Method Bias

Due to the study utilising self-reported primary data, the researchers addressed common method bias by adopting both ex-ante and ex-post controls. For the ex-ante controls, the study followed MacKenzie and Podsakoff (2012) advice and took steps such as (1) using different response anchor format for the independent and dependent variables, (2) informing participants of the anonymity of their responses, (3) adopting a multi-respondent strategy by interviewing two respondents in each firm, (4) sampling suitable participants that are knowledgeable enough to answer the survey and (5) assuring participants that there are no correct or incorrect responses to the questions. Furthermore, the study used an ex-post control to evaluate CMB by performing a single-factor test using method-only confirmatory factor analysis (CFA). In this test, all items were loaded on a single factor and model fit indices were assessed. The analysis indicated that the model had a poor fit: Yuan–Bentler Chi-square [$YB\chi^2$] = 556.081; [degree of freedom] $df = 77$; p -value = 0.000; Comparative Fit Index [CFI] = 0.531; Tucker–Lewis fit index [TLI] = 0.446; Standardized Root Mean Square Residual [SRMR] = 0.196; and root mean square error of approximation [RMSEA] = 0.224. This suggests that CMB does not threaten the study. In addition, the study included indirect and moderating links, thereby masking the proposed linkages from

respondents. Accordingly, CMB is unlikely to impact the analysis (MacKenzie and Podsakoff 2012).

4 | Analysis and Results

The covariance-based structural equation modelling (CB-SEM) technique was used for data analysis in R environment (version 4.1.4; R Core Team 2024). CB-SEM is the most suitable tool for testing and confirming theory in a research domain (Hair et al. 2019). The technique relies on multivariate normality, although robust maximum likelihood estimators can be used to accommodate non-normal data (Gaskin et al. 2025). Also, CB-SEM has the capacity to incorporate reflective latent variables, account for measurement error, and requires a minimum sample size of 100 to generate stable solutions for models (Hair et al. 2019). Finally, CB-SEM allows the assessment of global fit indices for the research model and the simultaneous estimation of interlinked hypotheses, thereby ensuring that theory testing reflects empirical reality (Gaskin et al. 2025). In this study, the CB-SEM analysis was conducted in two stages. The first stage assessed the measurement model to determine construct validity, whereas the second stage estimated the hypothesised structural model.

4.1 | Measurement Model Evaluation

To assess construct validity, a CFA was conducted with robust maximum likelihood estimation using the *lavaan* package in R (version 0.6–20, Rosseel 2012). The CFA demonstrated an excellent fit to the data: $YB\chi^2 = 68.401$; $df = 59$; $\chi^2/df = 1.159$; $p = 0.188$; CFI = 0.991; TLI = 0.988; SRMR = 0.040; and RMSEA = 0.035. Moreover, the calculated average variance extracted (AVE) values exceeded 0.50, and the composite reliability values for the measures were higher than the 0.70 benchmark (see Table 3). This suggests adequate reliability and convergent validity for

TABLE 3 | Descriptive statistics and bivariate correlations.

	CR	AVE	1	2	3	4	5	6	7
1. Environmental performance	0.865	0.681	<i>(0.864)</i>						
2. Top management environmental concern	0.881	0.645	0.406***	<i>(0.876)</i>					
3. Eco-product development effectiveness	0.948	0.859	0.530***	0.305***	<i>(0.948)</i>				
4. Environmental information sharing	0.764	0.522	0.387***	0.504***	0.357***	<i>(0.768)</i>			
5. CEO gender	—	—	0.003	−0.035	−0.133	−0.092	—		
6. CEO age	—	—	−0.081	−0.034	−0.177*	−0.256***	−0.160*	—	
7. Firm size	—	—	0.117	−0.002	0.082	0.087	−0.140	0.164*	—
Mean			5.511	5.595	4.979	4.897	0.363	2.690	0.862
Standard deviation			1.242	1.277	1.257	1.279	0.482	1.129	0.602

Note: Cronbach's alpha is shown in italics on the diagonal.

Abbreviations: AVE = average variance extracted; CR = composite reliability.

* $p < 0.05$.

*** $p < 0.001$.

TABLE 4 | HTMT values.

	1	2	3	4
1. Top management environmental concern	1.000			
2. Eco-product development effectiveness	0.604	1.000		
3. Environmental information sharing	0.331	0.415	1.000	
4. Environmental performance	0.460	0.471	0.585	1.000

the measures (Hair et al. 2019). Next, discriminant validity was assessed in two ways. First, the inter-pair correlations among the constructs were less than the AVE's square root value. Second, the estimated Heterotrait-Monotrait ratio of correlations (HTMT) values among the constructs were below the conservative 0.85 threshold (see Table 4). The results suggest the empirical distinction of the constructs (Henseler et al. 2015).

Table 3 presents the descriptive statistics and bivariate correlations, showing that top management concern ($r=0.406$, $p<0.001$) and eco-product development effectiveness ($r=0.530$, $p<0.001$) were both positively correlated with environmental performance. All bivariate correlations were below 0.60, suggesting no severe multicollinearity in the study (Hair et al. 2019).

4.2 | Structural Model Estimation

Since the research model integrates both moderation and mediation effects, the hypothesised relationships were tested using latent moderated structural equations (LMS) technique (Cheung and Lau 2017; Klein and Moosbrugger 2000) with robust maximum likelihood estimation via the *modsem* package in R (version 1.0.13; Slupphaug et al. 2025). The LMS technique models latent variable interactions directly using an expectation-maximisation (EM) algorithm to perform an iterative estimation of model estimates. As such, no product indicators are created (Klein and Moosbrugger 2000). While the LMS technique can be computationally intensive, the technique has better statistical efficiency and provides robust unbiased estimates than traditional regression technique (Cheung and Lau 2017; Slupphaug et al. 2025).

The estimated baseline model ($h0$ —without latent interaction terms) yielded an adequate fit: $YB\chi^2_{[87]}=104.73$; $p=0.095$; CFI=0.983; TLI=0.97; SRMR=0.044; RMSEA=0.035 with Akaike Information Criterion [AIC]=7708.11; and adjusted Bayesian Information Criterion [BIC]=7706.50. The interaction model ($h1$ —with latent interaction terms) yielded smaller values for AIC (7700.90) and adjusted BIC (7699.24). Also, a likelihood-ratio test (LRT) between the baseline model ($\log\text{-likelihood}=-3789.05$) versus the hypothesised interaction model ($\log\text{-likelihood}=-3783.45$) yielded a χ^2 difference=11.21 ($df=2$, $p=0.004$). This suggests that the hypothesised latent moderated model significantly provides a better explanation of the data (Klein and Moosbrugger 2000).

Table 5 presents the hypotheses testing results. Hypothesis 1 posited that top management environmental concern is positively related to environmental performance. Table 5 shows that top management environmental concern has a significant positive relationship with environmental performance ($B=0.282$, $SE=0.127$, $p=0.026$), thereby supporting Hypothesis 1.

Hypothesis 2 predicted that top management environmental concern is positively related to eco-product development effectiveness. As shown in Table 5, the relationship between top management environmental concern and eco-product development effectiveness was positive and significant ($B=0.321$, $SE=0.119$, $p=0.007$), supporting Hypothesis 2.

Hypothesis 3 argued that eco-product development effectiveness mediates the relationship between top management environmental concern and environmental performance. The mediation effect of eco-product development effectiveness was significant (indirect effect: $B=0.121$, $SE=0.050$, 95% CI [0.022, 0.220]). This result supports the mediation prediction in Hypothesis 3.

Hypothesis 4 proposed that environmental information sharing would positively moderate the link between top management environmental concern and environmental performance. Table 5 shows that the interaction term (environmental information sharing \times top management environmental concern) was positive and significantly related to environmental performance ($B=0.137$, $SE=0.052$, $p=0.008$). The interaction effect is displayed in Figure 2. A spotlight analysis showed that for firms that demonstrate a higher level of environmental information sharing, the positive influence of top management environmental concern on environmental performance was significant ($\text{simple slope}=0.438$, $z=2.602$, $p=0.009$) while for firms with a lower level of environmental information sharing, it was non-significant ($\text{simple slope}=0.127$, $z=1.231$, $p>0.050$). Thus, these results support Hypothesis 4.

Hypothesis 5 predicted that environmental information sharing would negatively moderate the relationship between eco-product development effectiveness and environmental performance. As shown in Table 5, the interaction of environmental information sharing and eco-product development effectiveness is significant and negatively associated with environmental performance ($B=-0.176$, $SE=0.049$, $p=0.000$). The interaction is illustrated in Figure 3. A spotlight analysis demonstrated that for firms experiencing low levels of environmental information sharing, the association between eco-product development effectiveness and environmental performance was significant ($\text{simple slope}=0.576$, $z=6.915$, $p<0.000$) but was nonsignificant for firms with high levels of environmental information sharing ($\text{simple slope}=0.176$, $z=1.620$, $p>0.050$). Hence, Hypothesis 5 is supported in the study.

4.2.1 | Additional Analysis

Although not hypothesised, an additional analysis was conducted using the LMS approach to evaluate the conditional indirect effect of top management environmental concern at high and low levels of environmental information sharing. The moderated mediation results revealed that the indirect

TABLE 5 | Structural model results.

	Eco-product development effectiveness			Environmental performance		
	B	SE	95% CI	B	SE	95% CI
<i>Covariates</i>						
CEO gender	-0.360	0.198	[-0.748, 0.029]	0.274	0.153	[-0.026, 0.573]
CEO age	-0.228**	0.078	[-0.380, -0.076]	0.066	0.079	[-0.089, 0.221]
Firm size	0.211	0.164	[-0.110, 0.532]	0.150	0.129	[-0.102, 0.402]
<i>Direct path</i>						
Top management environmental concern	0.321**	0.119	[0.089, 0.554]	0.282*	0.127	[0.034, 0.530]
Eco-product development effectiveness				0.376***	0.079	[0.221, 0.531]
Environmental information sharing				0.218	0.125	[-0.028, 0.464]
<i>Interaction path</i>						
Top management environmental concern × environmental information sharing				0.137**	0.052	[0.036, 0.238]
Eco-product development effectiveness × environmental information sharing				-0.176***	0.049	[-0.273, -0.080]
<i>Indirect path</i>						
Top management environmental concern → eco-product development effectiveness				0.121*	0.050	[0.022, 0.220]
<i>Index of moderated mediation</i>						
R ²	0.179			0.532		

Note: Abbreviations: B = unstandardised coefficient; SE = robust standard errors; CI = confidence interval.

*p < 0.05.

**p < 0.01.

***p < 0.001.

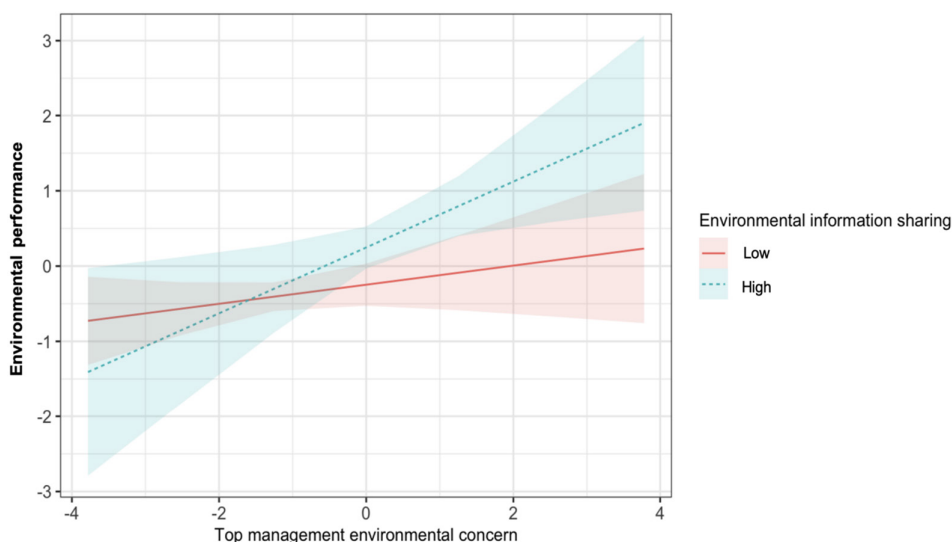


FIGURE 2 | Interaction of top management environmental concern and environmental information sharing on environmental performance. Source: Authors' own construction.

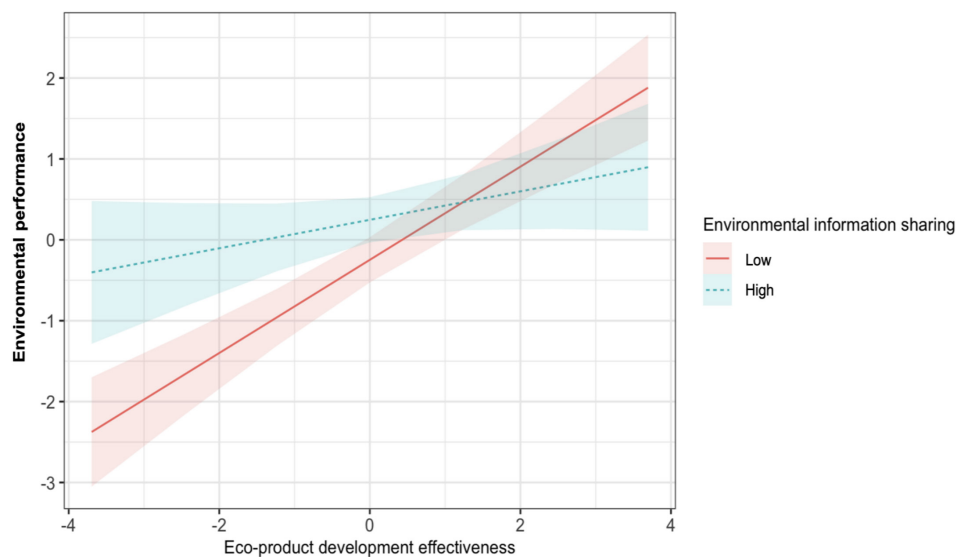


FIGURE 3 | Interaction of eco-product development effectiveness and environmental information sharing on environmental performance. Source: Authors' own construction.

effect of top management environmental concern through eco-product development effectiveness was conditional on the level of environmental information sharing ($Index = -0.057$, $SE = 0.027$, 95% CI $[-0.109, -0.004]$). Particularly, the indirect effect was significant ($B = 0.185$, $SE = 0.073$) at low levels of environmental information sharing (95% CI $[0.042$ to $0.328]$) but became nonsignificant at high levels of environmental information sharing ($B = 0.056$; 95% CI $[-0.021$ to $0.135]$). These results suggest that the indirect effect of top management environmental concern on environmental performance via eco-product development effectiveness differs across levels of the moderator, thereby lending further support for our mediation effect in Hypothesis 3.

5 | Discussion

This study combined insights from the upper echelons theory (Hambrick 2016) and resource-based theory (Barney et al. 2021) to investigate the underlying process by which top management environmental concern can promote firms' environmental performance. The study examined the mediating effect of eco-product development effectiveness and the moderating effect of environmental information sharing to elucidate this underlying process. The test of hypothesis with survey data collected from firms operating in Nigeria revealed the following findings:

First, the results show that top management environmental concern is a positive antecedent for facilitating environmental performance. This finding demonstrates the importance of top management behaviours to the firm-level environmental outcomes in firms (Mahran and Elamer 2024; Tang et al. 2024). Also, the finding aligns with previous research suggestion that top management values on environmental practices of their firms can improve environmental performance levels in organisations (Haldorai et al. 2022; Makhoulfi et al. 2022). Importantly, the results is consistent with the main postulation

of the upper echelons theory that firms' performance is a reflection of the behaviour, values and characteristics of top management (Hambrick and Mason 1984; Yue and Bajuri 2026).

Additionally, the results of hypothesis testing demonstrate a positive and significant relationship between top management environmental concern and eco-product development effectiveness. This signifies that top management concern for environmental issues can spur their firms' capacity to develop robust eco-product development effectiveness. The finding is in consonance with prior research contention that top management behaviours influence the environmental innovation efforts of firms (Adusei et al. 2025; Munawar et al. 2022). In addition, past research (e.g., Mo et al. 2022) found that firms with top management that are environmentally concerned are more likely to succeed in green innovation development.

Relatedly, the result of the study highlights that eco-product development effectiveness positively mediates the relationship between top management environmental concern and environmental performance. This finding suggests that as top management environmental concern increases, this sets the stage for enhancing firms' effectiveness in the eco-product development process. In turn, eco-product development effectiveness becomes the conduit for leveraging top management environmental concern to bolster firms' environmental performance. This finding is in line with earlier studies suggestion that intervening mechanisms related to eco-sustainability ensures that top management can harness their concern for environmentally friendly actions into improved environmental performance for their firms (Tang et al. 2024; Xie et al. 2024). In this regard, this mediation result further lends credence to the integration of upper echelons and resource-based theories in this study; in that top management behaviours (i.e., top management environmental concern) is a key driver for firms' competencies (i.e., eco-product development effectiveness), which in turn can enhance the achievement of firm objectives (i.e., environmental performance).

Moreover, the hypothesis testing result uncovers the differential moderating role of environmental information sharing. Specifically, the study finds that environmental information sharing positively moderates the link between top management environmental concern and environmental performance. From a resource-based perspective, this is consistent with extant research argument that environmental information exchange is a vital routine for supporting green knowledge management and enhancing environmental performance of firms (Chavez et al. 2021; Sahoo et al. 2023). A potential explanation for this positive moderating role of environmental information sharing could be that by exchanging fine-grained environmental information with external key partners such as suppliers and customers, top management can minimise information asymmetry and strengthen their firms' green knowledge resource synchronisation towards sustainable environmental practices (Agyabeng-Mensah et al. 2024).

On the other hand, the study finds that environmental information sharing negatively moderates the link between eco-product development effectiveness and environmental performance. This suggests that increases in environmental information sharing could lead to situations in which eco-product development effectiveness fails to support firms' environmental performance. A plausible rationale for this negative moderation effect might be that environmental information sharing may lead firms to become complacent about investing in green R&D to support their eco-innovation process. This can stifle strategic decision-making on eco-product development, thereby limiting firms' capacity to sustain their environmental performance.

6 | Implications and Future Directions

6.1 | Theoretical Implications

The findings of this study contribute to the extant literature in three ways. First, by demonstrating that top management environmental concern is a positive driver for improving environmental performance, this study extends the existing literature on how behaviours of the upper echelons of firms (i.e., top management) can shape the environmental practices of firms (Adusei et al. 2025; Tang et al. 2024). Thus, the study adds to the upper echelons perspective by going beyond studies that have usually utilised CEOs' characteristics in explaining environmental performance (cf. Mahran and Elamer 2024; Shahab et al. 2020). By so doing, the study answers the call for more research on how top management's concern for environmental issues can affect firms' environmental efforts (Makhloufi et al. 2022). Therefore, the study adds to the existing research stream on organisational outcomes of top management environmental concern (Mo et al. 2022; Le and Govindan 2024).

Second, this study adds to the environmental management literature (Huang et al. 2025) by investigating the indirect effect of eco-product development effectiveness to unlock the *black box* in the top management environmental concern—environmental performance linkage. Past research has largely overlooked eco-product development effectiveness in explaining the mediating mechanisms for boosting environmental performance (cf. Dubey 2025; Roh et al. 2022; Sahoo et al. 2023). Thus, this study

enriches the eco-innovation literature (Rabal Conesa et al. 2025) and extends the integration of upper echelon and resource-based theories (Hashim et al. 2026; Yang and Entebang 2025) by shedding light on eco-product development effectiveness as a conduit for linking top management environmental concern to environmental performance. The results imply that greater levels of top management environmental concern can foster eco-product development effectiveness, which in turn would generate better environmental performance for firms in the emerging market context. In so doing, this study improves current understanding of the antecedents and consequences of eco-product development effectiveness (Sahoo et al. 2024), while also offering a nuanced insight into the drivers of firms' environmental performance (Roh et al. 2022; Zhong et al. 2025).

Third, this study further extends the resource-based theory (Coates and McDermott 2002) and contributes to the environmental management literature (Agyabeng-Mensah et al. 2024; Chavez et al. 2021) on two separate fronts by examining the moderating impact of environmental information sharing. Firstly, the study provides new insight into the boundary conditions for top management environmental concern by highlighting that increased levels of environmental information sharing can amplify the effect of top management environmental concern on environmental performance. Secondly, the study broadens the implications of environmental information sharing on eco-product development effectiveness (Wong et al. 2020) by demonstrating that its main relationship with environmental performance diminishes when high levels of environmental information sharing are present. In this sense, this study enriches extant literature by providing empirical evidence for the paradoxical nature of environmental information sharing, where it can both stimulate and hinder firms' environmental performance depending on the context and manner of its application (cf. Wong 2013). Furthermore, as previous research has highlighted that the environmental management field still requires further contextualisation (Mahran and Elamer 2024), these findings regarding the differing moderating role of environmental information sharing help to enhance current understanding on when firms' environmental performance is more or less pronounced (Agyabeng-Mensah et al. 2024; Roh et al. 2022). Hence, the findings are paramount for CEOs and senior managers in emerging economies, where due to the lack of formal market structures, environmental information sharing with external partners is a necessary informal mechanism for engaging in environmental practices.

Overall, the study offers fresh context-based theoretical insights and responds to repeated calls for research that bridges the environmental management and entrepreneurship literatures (e.g., Jiang et al. 2025; Madrid-Guijarro and Duréndez 2024) by examining the research model in an African context (i.e., Nigeria) that is usually overlooked in debates surrounding environmental performance.

6.2 | Practical Implications

This study generates several relevant implications for practitioners and policymakers. Firstly, the study highlights the crucial need for top management (senior-level executives) of firms

to show a strong concern for environmental protection and design environmental management plans that align with their firms' resources. This can help build up a culture of environmental consciousness in the firm, thereby supporting the attainment of environmental performance.

Secondly, the study highlights the critical role of eco-product development effectiveness as a bridging competence that firms can utilise to harness the benefits of top management environmental concern. In particular, the study advocates that top management should align their environmental concerns with their firms' eco-product development processes to ensure both are tailored to the ecological requirements specified by regulators and other stakeholders. This can increase the likelihood that firms will yield better environmental performance.

Additionally, the study encourages firms to engage in environmental information sharing, as it provides a platform for comparative benchmarking of environmental practices with key external partners, thereby sharpening top management's perspectives on the environmental risks of their organisational processes. This could ultimately support firms in developing an environmental strategy that focuses on enhancing stakeholders' trust and detecting environmental risks. By contrast, the negative interaction between environmental information sharing and eco-product development effectiveness underscores the need for firms to develop a culture of stringent information-validation procedures for the environmental information being exchanged. This can help mitigate misalignment between shared environmental information and firms' eco-product development processes.

Given the growing attention of governments in emerging economies like Nigeria on promoting environmental management to combat climate change, policymakers could use media campaigns to educate firms on environmental issues and create certified workshops to engage top managers and strengthen their understanding of environmental protection. Also, the enforcement of certified green and eco-friendly labelling on products will strengthen environmental management and sustainability consciousness in top management decisions. This can stimulate their concern for environmentalism, which can further promote the effective development of eco-products and improve the environmental performance of firms.

6.3 | Limitations and Further Research

This study has limitations that offer opportunities for further research. Although the study collected data from the appropriate key informants in the sampled firms, the use of a cross-sectional survey limits the interpretation of the results to only correlational. Further research could adopt a longitudinal design and collect multiwave data to test for causality among the variables. Future research may adopt qualitative interviews to provide a more sophisticated perspective on the relationships between the constructs. Also, due to difficulties in assessing objective data on environmental performance and eco-product development effectiveness, these constructs were measured subjectively (cf. Roh et al. 2022). Such an approach can be affected by respondents' social desirability bias. To overcome this

limitation, additional research could consider collecting objective data to evaluate these variables. This could also help to mitigate measurement error and address potential endogeneity bias (Zaefarian et al. 2017).

Moreover, this study utilised eco-product development effectiveness as the only mediating mechanism. Future research can examine other intervening variables such as responsible entrepreneurship practices, environmental legitimacy and quality control management to push the extant literature further. Finally, the study focused on Nigeria as the empirical setting, which restricts the generalisation of the results to other contexts beyond Africa. Future investigations can conduct comparative studies using large technology firms versus SMEs from diverse countries in South America and Asia to validate the research model.

Author Contributions

Ayodele C. Oniku: supervision, conceptualization, investigation, methodology, writing – original draft, review and editing. **Awele Achi:** writing – original draft, review and editing, software, formal analysis, conceptualization. **Solomon Jeresa:** conceptualization, methodology, writing – original draft, review and editing. **Olamide O. Akintimehin:** investigation, formal analysis, writing – review and editing. **Adejumo Adepti:** conceptualization, writing – original draft, review and editing.

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Conflicts of Interest

The authors declare no conflicts of interest.

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