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RESEARCH ARTICLE

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Green creativity, responsible innovation, and product innovation performance: A study of entrepreneurial firms in an emerging economy

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Abstract

In this article, we investigate the effect of green creativity on product innovation performance through the mediating mechanism of responsible innovation. Further, we explore the moderating impact of resource commitment on the relationship between green creativity and responsible innovation. Utilizing a sample of 273 entrepreneurial firms in Vietnam, we find that green creativity positively influences responsible innovation. In addition, the results demonstrate that the effect of green creativity on responsible innovation is moderated by a firm's level of resource commitment to environmental innovation, such that the effect is more pronounced when a firm commits more resources to environmental innovation. Finally, we find the effect of green creativity on product innovation performance is mediated by responsible innovation. The theoretical as well as practical implications of the findings are discussed.

KEYWORDS
entrepreneurial firms, resource commitment; green creativity; product innovation; responsible innovation; sustainable development; Vietnam

1 | INTRODUCTION

The United Nations Sustainable Development Goals' (SDGs) call for firms to improve environmental sustainability through responsible innovation has prompted manufacturing organizations to develop green products (Ogbeibu et al., 2021; Välikangas, 2022). The commitment to this framework requires that entrepreneurial firms and other organizations take action that guarantees a sustainable future for the planet as a whole and the people inhabiting it. Relatedly, responsible innovation activities start with a firm's value systems and an approach that focuses on principles-based of doing business (Du et al., 2016; Whiteman et al., 2013). This suggests that firms should focus on meeting fundamental responsibilities by enacting values and principles in product development practices that do not harm consumers. Incorporating the SDGs into corporate strategies may help entrepreneurial firms establish a culture of integrity that allows them not only to uphold their basic responsibilities to consumers but also to set the stage for responsible innovation activities in terms of new product development. This commitment has prompted several entrepreneurial firms to develop core strategies that reflect human capital development to improve creativity and foster responsible innovation (Guston, 2013; Jiang et al., 2012). Innovation is "the generation, acceptance, and implementation of new ideas, processes, products or services" (Thompson, 1965, p. 2). Previous research indicates that innovation should be a key mechanism for firms to achieve the SDGs (Voegtlin & Scherer, 2017; Whiteman et al., 2013). Provided that entrepreneurial

Abbreviations: AVE, average variance extracted; CFA, confirmatory factor analysis; CR, composite reliability; EFA, exploratory factor analysis; SDGs, Sustainable Development Goals.

firms are an important source of innovation, they have the social responsibility to address sustainability concerns that relate to product development. It has been suggested that "although no consumer product has a zero impact on the environment, in business the terms 'green product' or 'environmental product' are used commonly to describe those that strive to protect or enhance the natural environment by conserving energy and/or resources and reducing or eliminating the use of toxic agents, pollution, and waste" (Ottman et al., 2006, p. 23). Our study defines green products as those that are less detrimental to the environment and human health and can be recycled.

Although previous literature has widely highlighted the importance of green products (e.g., Albino et al., 2009; Sarkar et al., 2022), research on how green creativity affects green product performance through responsible innovation in emerging market entrepreneurial firms is scarce. Prior research indicates that green product innovation performance is driven by the development of products with the core attributes that can satisfy the needs of customers and stakeholders (Chen & Chang, 2013; Du et al., 2016). Further, extant research indicates that green product innovation is now considered imperative for many organizations (Dangelico & Pujari, 2010; Xie et al., 2019). Given that environmental protection has become the main issue due to the impact of businesses on the environment, entrepreneurial firms are now developing green products to satisfy the need of the stakeholders (Chen, 2011). In addition, business leaders believe that the integration of green strategy in the form of green product development into their business models is critical for meeting social needs and reducing environmental impact (PriceWaterhouseCooper, 2014). Successful green product development can aid entrepreneurial firms in moving toward environmental sustainability. This shift has motivated several companies to integrate sustainability into their core business models, including employee training, supply chain management, and product development (Adomako & Tran, 2022c; Khizar et al., 2022; Porter & Kramer, 2011). Moreover, green products play an important role for entrepreneurial firms to effectively respond to stakeholder green pressures (Adomako et al., 2022). Thus, green product development, responsible innovation, and sustainability have increasingly become important corporate strategic issues for achieving competitive advantage (Albino et al., 2009; Chen, 2001; Dost et al., 2019). For example, responsible innovation, described as a new or considerably enhanced product, service, or business model whose commercialization solves or alleviates environmental or social problems (Halme & Korpela, 2014), has gained substantial traction in corporate boardrooms as well as in the popular business press.

Despite the substantial effort in delineating the importance of green products, we still lack a solid understanding of how green creativity impacts green product performance. The current study fills this gap in our knowledge. In this study, we propose that green creativity—defined as the act of generating and producing green ideas, approaches, and actions (Chen & Chang, 2013)—would influence green product performance through responsible innovation (i.e., how firms take care of the future through collective stewardship of science and innovation in the present). We further contend that the impact of green creativity on responsible innovation is conditioned by a firm's level of resource commitment to environmental sustainability. Thus, this article explores the role of green creativity in green product performance through the mediating mechanism of responsible innovation.

This article, therefore, contributes to the responsible innovation literature in three specific ways. First, despite the substantial effort on business outcomes of creativity (Gong et al., 2013; Rank et al., 2004), previous research has rarely investigated the relationship between green creativity and responsible innovation. This study seeks to extend prior literature by examining whether and how green creativity influences responsible innovation outcomes. By highlighting its positive influence on responsible innovation, our study strengthens the business case of responsible innovation. Second, we find that green creativity influences green product performance through responsible innovation. This finding highlights the underlying mechanism for the link between green creativity and green product performance. We add to the extant literature by arguing that responsible innovation is a clear pathway through which green creativity positively influences green product performance. Third, this study seeks to explain the condition under which green creativity is more or less pronounced in responsible innovation outcomes. Third, we find that a firm's level of resource commitment to environmental sustainability moderates the association between creativity and responsible innovation. To the best of our knowledge, this study is among the first to examine this moderating effect. The finding extends the current understanding of the conditions in which green creativity will improve responsible innovation in entrepreneurial ventures.

The rest of the paper is organized as follows. First, we review the extant literature and develop the study's hypotheses. Second, we outline the methodology and explain how the constructs were measured. Third, we present the study findings. Finally, the findings are discussed, and contributions and limitations for future research are provided.

2 | THEORETICAL BACKGROUND AND HYPOTHESES

2.1 | Dynamic capabilities' perspective

The resource-based view (RBV) suggests that a firm's resources and capabilities are valuable, rare, and inimitable, and these resources form the basis of sustained competitive advantage (Barney, 1991). Two main views are advanced by the RBV theory. These are (1) firms should be able to achieve sustainable competitive advantage through their bundle of resources and (2) a firm's ability to adapt to and take advantage of its dynamic environment (i.e., dynamic capabilities). The dynamic capabilities perspective suggests that the firm's ability to exploit its resources and capabilities is critical. Yet, it is also important for the firm to compete to renew and develop its capabilities to face the uncertainties surrounding the business environment (Teece et al., 1997; Teece & Pisano, 1994). Thus, it is not a sufficient condition to have capabilities to remain competitive, but the ability to renew and develop firm-level capabilities is a necessary condition for achieving competitive advantage.

Dynamic capabilities allow firms to respond to dynamic market conditions by developing and renewing their resources and capabilities (Winter, 2003). Additionally, dynamic capabilities help firms to go beyond their current routines to deal with different problems (Zahra et al., 2006). Given the unpredictable nature of the business environment, green creativity is useful for generating new ideas that can help a firm to improvise for responsible innovation (Sauer & Bonelli, 2020). Creativity within a firm acts to generate and produce new ideas, approaches, and actions. Innovation, on the other hand, is considered the way ideas are converted into a novel and authentic commercial products, services, and firm practices (Wyer et al., 2010). It is important to argue that creativity is critical for a firm to embark on its innovation projects because creativity serves as the starting point for a firm to commercialize its products and services (Amabile et al., 1996). As a dynamic capability, green creativity may be an important driver of responsible innovation. We propose that green creativity, defined as "the development of new ideas about green products, green services, green processes, or green practices that are judged to be original, novel, and useful" (Amabile, 1988, p.153), is an important predictor of product innovation performance.

In most cases, a dynamic capability originates from managerial skills, competencies, and creativity (Teece, 2007; Teece et al., 1997) that are mostly used to create and exploit opportunities. The development of managerial creativity and competencies has emanated as a sub-field of dynamic capabilities (Ferreira et al., 2020; Helfat & Martin, 2015). As such, managerial capabilities are considered a major driver of business model design and implementation (De Silva et al., 2021; Hock-Doepgen et al., 2021). Given that managerial creativity and skills are derived from the characteristics of managers, they are difficult for competitors to replicate (Teece, 2014). In addition, because these characteristics are unique and valuable, managerial creativity can serve as an organization's foundation for responsible innovation, which could ultimately lead to product innovation performance.

2.2 | Responsible innovation

The idea of responsible innovation is an important part of new product development, reflecting that new products should not damage the health of consumers and the general public (Adomako & Tran, 2022a; Voegtlin & Scherer, 2017). Instructively, innovation (i.e., the generation, acceptance, and implementation of new ideas, processes, products, or services) is an important mechanism for attaining these goals.

Responsible innovation is the process by which organizations and their stakeholders generate value mutually beneficial and sustainably (Bacq & Aguilera, 2022). Stilgoe et al. (2020) defined responsible innovation as "taking care of the future through the collective stewardship of science and innovation." Relatedly, responsible innovation generates both private and societal values by contributing to the production of public goods (Bacq & Aguilera, 2022). In addition, responsible innovation pertains to a new or significantly improved product, service, or business model whose introduction to the market solves or mitigates an environmental or social issue (Halme & Korpela, 2014). Responsible innovation can bring various competitive benefits to firms, such as stakeholders' satisfaction and social image (Haned et al., 2014; Zhu et al., 2019) and sustainable (social, environmental, and economic) performance (Xie et al., 2022).

Given the importance of responsible innovation, several studies have investigated the antecedents of responsible innovation to provide managerial implications to firms striving to boost their responsible innovation practices (e.g., Adomako & Tran, 2022a; Christofi et al., 2022; Hadj, 2020; Zahoor et al., 2022). For example, responsible innovation can be affected by corporate social responsibility, as it can be viewed from the standpoint of sustainability, encompassing social, environmental, and economic consequences (Christofi et al., 2022). Evidence from North Africa shows that responsible innovation can be encouraged in small and medium-sized enterprises (SMEs) as way to improve their corporate social responsbility (CSR) toward both internal and external stakeholders (Hadj, 2020). A further study conducted in Ghana by Adomako and Tran (2022a) revealed that firms with strong environmental collaboration with suppliers in planning and executing a joint strategic approach to environmental management could obtain knowledge about environmental management and responsibility from their suppliers, which, in turn, influences responsible innovation. Furthermore, in the context of SMEs, responsible innovation can be facilitated by alliance learning (i.e., the extent to which knowledge is learned and acquired from alliance partners) through their absorptive capacity and sense-making competency (Zahoor et al., 2022).

Although previous studies examined the factors that contribute to responsible innovation, they did not investigate whether green creativity can serve as a facilitator. Moreover, little is known about how a firm's resource commitment can interact with its green creativity to promote responsible innovation and whether this promoted responsible innovation can enhance product innovation performance. Consequently, this study focuses on the effect of green creativity on green product innovation performance via the mediating role of responsible innovation, as well as the moderating effect of resource commitment on the relationship between green creativity and responsible innovation. The proposed model and its hypotheses are shown in Figure 1.

2.3 | Green creativity and responsible innovation

Creativity is critical for generating new and relevant ideas that are considered useful for innovation in organizations (Wyer et al., 2010). It is considered creativity is the act of generating and producing new ideas, approaches, and actions. On the hand, innovation is the process that converts those ideas into novel, useful, and viable commercial products, services, and business practices (Wyer et al., 2010). Thus, creativity is a necessary condition for innovation to flourish (Amabile et al., 1996). Accordingly, in our first hypothesis, we proposed that green creativity would improve responsible innovation in entrepreneurial ventures. First, previous studies have underscored that green creativity is an important antecedent of green innovation (e.g., Song & Yu, 2018). The perception of innovation is related to the creativity

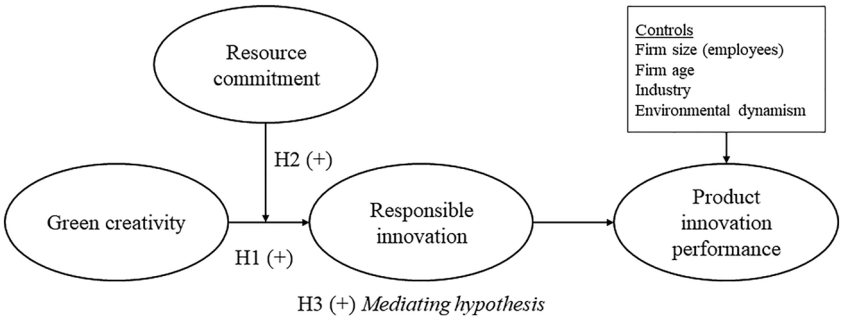

FIGURE 1 Proposed model

climate Lin and Liu (2012), and thus, employee creativity can act as a springboard for innovation (Amabile, 1988). Employees with green creativity may proactively find ways to translate their creative ideas into new green services that address changes in market preferences (Luu, 2022). In a creative environment characterized by low levels of external control and work pressure, employees may perceive greater autonomy at work and consequently perform better on innovative tasks (Liu et al., 2011). Second, green creativity focuses primarily on generating novel and practical ideas for green products, processes, services, and practices to tackle environmental issues (Song & Yu, 2018). Therefore, green creativity is essential for enabling green product and process innovation (Song & Yu, 2018). By adopting creative green solutions from their employees, organizations can create innovative services to meet their social responsibilities and environmental objectives (Song et al., 2020). Third, it has been suggested that creativity is one of the factors that drive innovation. For example, previous research notes that "all innovation begins with creative ideas … creativity by individuals and teams is a starting point for innovation …." (Amabile, 1996, p. 143). Stated differently, the outcomes of green creativity such as new ideas, or concepts, serve as the "ingredients" for innovation. Moreover, creativity is frequently stated as the necessary condition for subsequent innovation, though not a sufficient condition since most ideas generated by creativity are not commercialized (Baron & Tang, 2011; McMullen & Shepherd, 2006).

Fourth, previous scholarly development suggests that managers exert a powerful influence on organizational cultures (Baron & Tang, 2011; Gartner et al., 1994). For example, managerial values are critical for defining the nature of culture and norms in an organization (Baum & Locke, 2004). This suggests that a high level of creativity is likely to yield an organizational culture that cherishes innovation. A culture of innovation can be established through managers who show creativity in their behavior. Additionally, extant research shows the importance of managerial creativity in the development of new products and services (Leiblein, 2007; Snow, 2007). Collectively, there is a theoretical ground to propose that managerial creativity predicts innovation. Accordingly, we propose the following hypothesis:

H1. Green creativity is positively related to responsible innovation.

2.4 | The moderating effect of resource commitment

Resource commitment is the devotion of financial and nonfinancial resources that cannot be used for other purposes without incurring costs (Osland et al., 2001). In other words, resource commitment reflects the allocation of valuable resources in social and environmental activities (Li, 2014; Richey et al., 2005). According to the RBV (Barney, 1991), the effective allocation of valuable, rare, and inimitable resources is central to achieving competitive advantage. In other words, the matching and commitment of resources to specific activities such as responsible innovation can yield innovation performance (Daugherty et al., 2005). This view is supported by the resource advantage theory that argues that the use of resources to achieve sustainable competitive advantage is likely to yield innovation (Chen & Chen, 2013; Hunt & Morgan, 1996). Particularly in comparison to other environmental practices, green innovation is a proactive approach with a relatively long investment period and a higher resource commitment (Wang et al., 2018). For example, in the tourism industry context, financial and human resources are significant obstacles to developing green practices in tourist hotels (Mittal & Dhar, 2016; Siyambalapitiya et al., 2018). On the other hand, green product design may improve firm performance for organizations that commit more resources to green product activities (Adomako & Tran, 2022d; Zhang & Walton, 2017). In addition, the commitment of resources to green practices improves the effectiveness and efficiency of green-oriented businesses (Zhang & Walton, 2017). According to the natural RBV of the firm, resource commitment to cope with natural environmental issues has prompted the development of innovative social and environmental responsibility initiatives.

However, investments in environmental issues incur substantial opportunity costs because such investments divert resources from being invested in other profitable opportunities (Ambec et al., 2013). Thus, without sufficient resource commitment to environmental sustainability, firms even with high levels of green creativity may struggle to pursue and realize responsible innovation. We contend that firms that commit resources to green innovation tend to convert the green ideas that originated from creativity into responsible innovations more rapidly and intensively than those with less resource commitment to green innovation. Therefore, we propose the following hypothesis:

H2. Resource commitment positively moderates the relationship between green creativity and responsible innovation.

2.5 | The mediating role of responsible innovation

Previous studies have established the relationship between green creativity and product innovation performance (e.g., Chen & Chang, 2013; Song et al., 2020). Yet, the mechanism that explains this relationship is poorly understood. Research has revealed that the strategic application of responsible innovation gives rise to various benefits, including innovative products, and new markets, and boosts productivity (e.g., Halme & Korpela, 2014; Long & van Waes, 2021; Owen et al., 2013). For example, responsible innovation links to introducing a new or better product that either addresses or mitigates environmental or social problems (Halme & Korpela, 2014). In addition, responsible innovation can help inform business model innovation outcomes (Long & van Waes, 2021). Responsible innovation is considered a part of sustainable innovation (Genus & Iskandarova, 2018; Zahoor et al., 2022) that incorporates social, environmental, and economic rationale. It involves incorporating ethical and social considerations into product development cycles and business models (van Beers et al., 2020). Hence, we argue that the relationship between green creativity and product innovation performance is mediated by responsible innovation necessitates. This is because for creativity to yield its potential outcomes such as innovation, it needs to focus on processes that satisfy the qualities of anticipatory, thoughtful, deliberative, and responsive behavior (Owen et al., 2013). It is also important to focus on products or outcomes of innovation that conform to ethical principles (Van den Hoven, 2014). To achieve environmental objectives and satisfy their social expectations and needs, firms must focus on enhancing new and novel green ideas for green products, which can increase the probability of developing new products when these innovative ideas are implemented, thereby enhancing green product innovation performance (Song et al., 2020). Therefore, firms with a high level of green creativity can effectively respond to consumer needs regarding green products, resulting in superior product innovation performance. Accordingly, we proposed the following hypothesis:

H3. Responsible innovation mediates the relationship between green creativity and product innovation performance.

3 | RESEARCH METHOD

3.1 | Sample and data

The data for this study were obtained from founders/senior managers (i.e., chief executive officers [CEOs] and finance managers) of entrepreneurial ventures in Vietnam. We randomly selected 600 entrepreneurial firms from the Vietnam Business Directory. The firms were manufacturing firms that produced physical products. In addition, to qualify for participation, a firm must employ not more than 250 full-time workers as of the time of data collection. In addition, the firms should have introduced one green product in the last 3 years. Further, to qualify for participation, the firms should not be part of any company group or subsidiary of a multinational company. Finally, the firms should have the contact details of the CEO. To solicit participation, we sent letters to each selected company's CEO. The letters explained the purpose of the study and asked for cooperation in completing the survey. The questionnaire maintained a language equivalence by focusing on back-translation. It was first published in English, then translated into Vietnamese before being retranslated into English by bilingual writers (Nguyen et al., 2023). To obtain a high response rate and provide reliable and accurate data, we promised the CEOs a summary of the study's results. In addition, we promised the CEOs anonymity.

In May 2021 (i.e., 1 month after the letters were sent), two research assistants visited the companies, gave questionnaires to the CEOs, and agreed on the date to collect the completed questionnaire. After several visits to the companies, we obtained 290 completed questionnaires. After eliminating missing values, we received 276 completed responses in wave 1. In wave 2 (i.e., 3 months after wave 1), we contacted the finance directors/managers of the 276 firms and handed over another questionnaire to capture the dependent variable (i.e., green product innovation performance). The two-wave design was used to reduce potential common method variance associated with cross-sectional data (Podsakoff et al., 2012). After two visits to the companies, we received 273 complete responses from wave 2. This represents a 45.5% response rate. The sample contains firms with a mean age of 9.01 (S.D. = 6.85) years and a mean size of 23.23 (S.D. = 12.34) full-time employees. The results also show that 56% were in the high technology industry, while 44% were operating in the low technology industry.

To account for non-response bias, we compared early and late respondents in terms of firm age, firm size, and industry. The results of a *t* test revealed no significant differences between the two groups. Thus, non-response bias should not be considered a substantial problem in this study.

3.2 | Measures

All the multi-item measures were captured on a 7-point Likert scale with anchors ranging from 1 = *strongly disagree* to 7 = *strongly agree*. Table 1 provides details of the measures, reliability, and validity.

3.2.1 | Green creativity

This construct reflects "the development of new ideas about green products, green services, green processes, or green practices that are judged to be original, novel, and useful" (Amabile, 1988; Chen &

TABLE 1 Measures, reliability, and validity assessment

Description of the measurement items	Factor loadings
Green creativity: $\alpha = .89$; CR = .90; AVE = .61	
The members of the green product development project suggest new ways to achieve environmental goals	.78
The members of the green product development project proposed new green ideas to improve environmental performance	.80
The members of the green product development project promote and champion new green ideas to others	.82
The members of the green product development project develop adequate plans for the implementation of new green ideas	.76
The members of the green product development project would rethink new green ideas	.79
The members of the green product development project would find out creative solutions to environmental problems	.75
Resource commitment: $\alpha = .86$; CR = .86; AVE = .61	
We have sufficient financial resources to invest in environmental innovation practices	.75
We have sufficient management resources to invest in environmental innovation practices	.77
We have sufficient investment in software establishment (e.g., introduction of technology and human resource training) for environmental innovation practices	.80
We have sufficient investment in hardware establishment (e.g., equipment and green material purchasing) for environmental innovation practices	.82
Responsible innovation: $\alpha = .88$; CR = .89; AVE = .57	
Our company produces new products/services that demonstrate a willingness to add value to customers' wellbeing	.80
On average, each year, we introduce new products/services that provide the social welfare needs of our customers	.81
Industry experts would say that we are more prolific when it comes to launching products that aim at implementing resource conservation and environmental protection	.77
Our new product offerings offer solutions for a better future	.74
Our company has introduced new products/services that capture the responsible side of innovation	.73
Our company is good at introducing responsible solutions to a meaningful problem	.69
Environmental dynamism: $\alpha = .91$; CR = .92; AVE = .79	
Competitors are constantly trying out new competitive strategies	.88
Customer needs and demands are changing rapidly in our industry	.89
New markets are emerging for products and services in our industry	.90
Product innovation performance: $\alpha = .85$; CR = .86; AVE = .61	
To what extent your company has achieved its product development objectives in terms of the following in the last 3 years:	
Revenues from green products compared with business objectives	.79
Growth in revenue from green products compared with business objectives	.82
Growth in sales of green products compared with business objectives	.76
Profitability of green products compared with business objectives	.77

Chang, 2013). Accordingly, six items were taken from Chen and Chang (2013) to measure green creativity.

3.2.2 | Resource commitment

We measured resource commitment to environmental innovation with four items from Li (2014). A sample item is "We have sufficient financial resources to invest in environmental innovation practices."

3.2.3 | Responsible innovation

We measure responsible innovation with six items that were derived from Adomako and Tran (2022a). Employing exploratory factor analysis (EFA) with direct oblimin rotation, one factor was derived for the responsible innovation scale. We deleted one item due to high cross-loadings. The use of oblimin rotation allows an item to freely load on multiple factors, hence showing its true impact across all factors.

3.2.4 | Green product innovation performance

This construct was measured by adopting four items from Atuahene-Gima et al. (2005). Finance managers/chief accountants were asked to evaluate their companies' green product revenues, growth in revenues from green products, the profitability of green products, and growth in sales of green products (Adomako et al., 2022).

3.2.5 | Control variables

We controlled for firm age, firm size, industry type, and environmental dynamism. This is because these variables have the potential to influence the outcome variable (Adomako & Tran, 2022b). Firm age was measured as the age since the firm was established. Firm size was measured as the number of full-time employees. Given that data were collected from the manufacturing industry, we included an industry dummy as follows: 0 = high technology industry and 1 = low technology industry. Finally, we measured environmental dynamism with three items from Miller and Friesen (1982). The items captured managerial perceptions of the target market environment's degree of variation.

3.3 | Common method bias assessment

Although we collected data on the dependent and independent variables from different respondents using the time-lag approach, we tested for potential common method bias. First, we ran a Harman one-factor test (Podsakoff & Organ, 1986) in which all the perceptual items were loaded into an EFA. According to this approach, common method bias should be a concern if a single factor emerges from the factor analysis or factor 1 accounts for the majority of the variance. The results of the factor analysis resulted in a solution that accounted for 70.33% of the total variance, and factor 1 accounted for 16.23%. Given that a single factor did not emerge, and factor 1 did not explain most of the variance, common method bias is unlikely to be a concern in our data.

Second, we assessed the potential influence of common method bias using the market variable method (Lindell & Whitney, 2001). Accordingly, we used a marker variable that was conceptually unrelated to at least one variable in our model to represent the potential for common method bias. The marker variable used was "I like the red color." The lowest positive correlation ($r = .005$) between the marker variable and product innovation performance was employed to adjust the correlations and statistical significance. Our results show that none of the significant correlations becomes nonsignificant after adjusting for common method bias. Thus, common method bias is not a serious concern in this study.

3.4 | Validity and reliability assessment

We performed a confirmatory factor analysis (CFA) to assess construct validity. The results of the CFA are presented in Table 1. We used well-established measures to assess the fit of our CFA model 1 (Bentler, 1990; Schermelleh-Engel et al., 2003). These are the goodness of fit index (GFI), IFI Delta 2, the Tucker–Lewis index (TLI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). The overall measurement model provides a satisfactory fit to the data ($\chi^2(129) = 303.290$, $p < .001$; GFI = 0.91; IFI = 0.96, TLI = 0.94, CFI = 0.95, RMSEA = 0.05). The results also revealed that all the indicators loaded significantly on their respective constructs ($p < .001$), suggesting convergent validity and discriminant validity for our measures. We also found that composite reliability was greater than .70 and the values of average variance extracted (AVE) were greater than the .50 threshold value (Fornell & Larcker, 1981).

Additionally, two approaches were used to assess discriminant validity. First, pair-wise Chi-square tests for all the latent constructs were performed to establish whether the constrained and unconstrained models differed significantly. In all cases, the unconstrained model produced a better model fit, and the results of the Chi-square difference tests were significant ($p < .001$), supporting discriminant validity. Second, we inspected the square roots of the AVE values and found that in each case, the square root of the AVE values was greater than the correlations of any pair of latent variables. This provides additional support for discriminant validity (Fornell & Larcker, 1981). Table 2 provides details of the means, standard deviations, and correlations of the tested variables in this study.

4 | ANALYTICAL PROCEDURE AND RESULTS

We present the descriptive statistics and correlations in Table 2. Before the main regression analysis, the variances involved in the interaction were mean-centered to prevent multicollinearity (Aiken et al., 1991). Given that the largest variance inflation factor (VIF) value was 2.22, it was safe to conclude that multicollinearity is not a substantial issue in our analysis (Neter et al., 1996). The was also checked against any violations of normality assumptions and outliers. The results indicate no significant violations. Thus, the data were suitable for regression analysis. We, therefore, utilized hierarchical regression analysis to test our hypotheses. The results of the regression analysis are presented in Table 3.

In Models 1–4, the dependent variable is responsible innovation. The dependent variable in Models 5–8 is green product innovation performance. Model 2 added green creativity, and the results in Model 2 show that green creativity has a significant influence on responsible innovation ($\beta = .25$, $p < .01$). This provides support for H1. In Model 3, when the moderator (i.e., resource commitment) was added to the regression equation, the influence of green creativity on responsible innovation was still significant ($\beta = .22$, $p < .01$).

In Model 4, the interaction terms between green creativity and resource commitment (i.e., green creativity × resource commitment) were included. The interaction is positive and significant ($\beta = .35$, $p < .01$). This result suggests that a firm's resource commitment positively moderates the relationship between green creativity and responsible innovation. This provides support for H2. To establish the direction of this interaction effect, we used convention practice for plotting simple slopes (see Figure 2) at one standard deviation above and below the mean of resource commitment. As anticipated, the slope of the relationship between green creativity and responsible innovation was strong when resource commitment is high (simple

TABLE 2 Descriptive statistics and correlations

	Variables	Mean	S.D.	1	2	3	4	5	6	7
1.	Firm size (employees)	23.23	12.34							
2.	Firm age (years)	9.01	6.85	−.11						
3.	Industry	0.56	0.48	−.15*	−.11					
4.	Environmental dynamism	5.09	1.19	−.13	−.07	.22**				
5.	Green creativity	4.95	1.08	.15*	.11	.12	.27**			
6.	Resource commitment	4.38	1.27	.28**	.15*	−.10	−.11	.10		
7.	Responsible innovation	5.21	0.99	−.11	−.12	.12	.13	.26**	.23**	
8.	Green product innovation performance	5.19	1.02	−.09	−.11	.06	.22**	.33**	.22**	.36**

Abbreviation: S.D., standard deviation.
*$p < .05$.
**$p < .01$ (two-tailed test).

TABLE 3 Regression results

	Models 1–4: Responsible innovation				Models 5–8: Product innovation performance			
Control variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Firm size (employees)	−0.05	−0.05	−0.03	−0.04	−0.06	−0.06	−0.05	−0.05
Firm age	−0.06	−0.06	−0.05	−0.05	−0.08*	−0.08*	−0.06	−0.03
Industry	0.06	0.05	0.04	0.04	0.04	0.04	0.04	0.03
Environmental dynamism	0.12*	0.11*	0.10*	0.08*	0.14**	0.13**	0.12*	0.11*
Independent variable								
Green creativity		0.25***	0.22***	0.18***		0.29***	0.26***	0.04
Moderator								
Resource commitment			0.19***	0.17***		0.20***	0.19***	0.15***
Interaction								
Green creativity × resource commitment				0.35***				0.49***
Mediator								
Responsible innovation							0.37***	0.32***
Model fit statistics								
F value	1.44	3.98***	4.66***	5.89***	1.62	3.89***	4.90***	5.93***
R^2	.11	.15	.18	.22	.12	.15	.17	.20
ΔR^2	-	.04	.03	.04	-	.03	.02	.03
Largest VIF	1.11	1.07	1.29	1.33	1.29	2.19	2.11	2.22

Note: $N = 273$. Standardized coefficients are shown.
*$p < .10$.**$p < .05$.***$p < .01$.

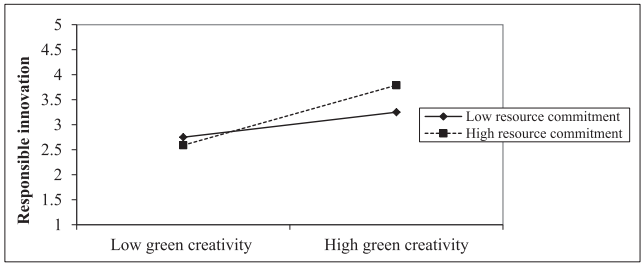

FIGURE 2 Interaction effect of green creativity with resource commitment to responsible innovation

slope = 0.35, $t = 3.79$, $p < .01$), whereas the slope was weak when resource commitment is low (simple slope = −0.03, $t = -0.14$, $p > .10$).

The dependent variable in Models 5–8 is responsible innovation. We test the mediation hypothesis (H3) in Models 5–8. Following the procedure suggested by Zhao et al. (2010), we tested H3. First, the independent variable should be related to the mediating variable. As can be seen in Model 2, the relationship between green creativity and responsible innovation was positive and significant ($\beta = .25$, $p < .01$). Second, the mediating variable should be significantly related to the dependent variable. The results in Model 7 demonstrate that

TABLE 4 Moderated mediation results for green product innovation performance across levels of resource commitment

	Product innovation performance				
Moderator	**Level**	**Conditional indirect effect**	**SE**	**LL 95% CI**	**UL 95% CI**
Resource commitment	Low (−1.23)	−0.01	0.03	−0.01	0.03
	High (1.23)	0.04	0.06	0.02	0.19

Note: $N = 273$. Results are based on 10,000 bootstrap sample.

responsible innovation positively relates to green product innovation performance ($\beta = .37$, $p < .01$). Third, the relationship between the independent variable and the dependent variable should be nonsignificant or weaker when the mediating variable is added to the regression. The results in Model 8 reveal that when both green creativity and responsible innovation are added to the regression equation, responsible innovation has a positive influence on green product innovation performance ($\beta = .25$, $p < .01$). In addition, the effect of green creativity on green product innovation performance is nonsignificant ($\beta = .04$, $p > .10$). These results provide support for H3.

We also confirmed H3 by following Hayes and Preacher (2010). Specifically, we tested the significance of the indirect effects utilizing the Sobel test and bootstrapping. The formal two-tailed significance test revealed that the indirect effect was significant (Sobel $z = -2.14$, $p = .05$). We then used the bootstrapping results to confirm the Sobel test. Accordingly, we estimated a 95% bias-corrected confidence interval (CI) for indirect effects by bootstrapping 10,000 samples. According to Shrout and Bolger (2002), if the results of the CI do not contain zero, it can be concluded that the indirect effect is established. In our case, the CI ranged from 0.03 to 0.13, crossing no zero in CI. This suggests that the indirect effect is statistically significant in our model, thus confirming H3.

Finally, using Preacher et al.'s (2007) SPSS macro, we examined the conditional indirect effect of green creativity on green product innovation performance (through responsible innovation) at the values of the moderator (resource commitment). Accordingly, we set high and low levels of resource commitment at one standard deviation above and below the mean score of resource commitment. The results of the PROCESS macro (Table 4) indicated that the indirect effect of green creativity on green product innovation performance via responsible innovation was conditional on the level of resource commitment. The indirect effect was stronger (0.04) and significant at a high level of resource commitment (CI ranging from 0.02 to 0.19 and not crossing zero) but was weaker (−0.01) and insignificant at a low level of resource commitment (CI ranging from −0.01 to 0.03, crossing zero). These results further provide support for H3.

5 | DISCUSSION AND CONCLUSION

Our article investigated the impact of green creativity on product innovation performance through the mediating mechanism of responsible innovation. We also examined the condition in which green creativity is likely to improve responsible innovation by arguing that a firm's level of resource commitment to environmental innovation relative to its industry rivals would represent theoretically meaningful boundary conditions on the responsible innovation–product innovation performance relationship. Time-lagged data from 273 entrepreneurial firms in Vietnam supported our hypotheses. Specifically, our finding that green creativity positively relates to responsible innovation highlights the importance of the previously neglected role of green creativity in explaining a firm's responsible behavior (Liedong, 2021; Stilgoe et al., 2020). By integrating insights from a dynamic capabilities perspective (Teece et al., 1997; Teece & Pisano, 1994) and extant research (Chen, 2001; Chen & Chang, 2013), our study argues that firms must develop creativity, which is crucial for innovation (Halbesleben et al., 2003). Thus, our results confirm the possibility of green creativity driving responsible innovation and new product success (Chang et al., 2010). Our second finding (i.e., resource commitment moderates the relationship between green creativity and responsible innovation) provides a better understanding of the conditions under which green creativity facilitates responsible innovation. The third finding (i.e., responsible innovation is the mediator between green creativity and product innovation performance) highlights the mechanism through which green creativity improves product innovation performance. Collectively, these findings provide several theoretical and practical implications.

5.1 | Theoretical implications

Our findings extend the existing literature in three ways. First, this article suggests that green creativity improves responsible innovation. The existing literature on responsible innovation (Adomako et al., 2022; Tsai, 2009) has not explained how green creativity enhances a firm's level of responsible innovation. Thus, we add to this stream of research by suggesting that efforts to increase responsible innovation should be tailored to improving the green creativity concept as part of firms' long-term environmental strategies. Second, our study extends our understanding of the boundary conditions of the effects of green creativity. Although the effects of green creativity on innovation have been previously investigated (Chen & Chang, 2013; Song et al., 2020), research is lacking on the conditions under which green creativity is more or less pronounced. We add to the existing green creativity literature by empirically investigating the boundary conditions of the effects of green creativity. Particularly, the finding in

H2 indicates that resource commitment is such a boundary condition. Thus, at a high level of green creativity, resource commitment may facilitate the positive effect of green creativity in responsible innovation activities. Third, we show that responsible innovation mediates the positive relationship between green creativity and product innovation performance. By this finding, we extend the innovation literature (Bustinza et al., 2022; Varriale et al. (2022) by highlighting the mediating role of responsible innovation in the link between green creativity and product innovation performance. The responsible innovation literature has traditionally argued that innovations by firms should take into consideration future collective stewardship (Stilgoe et al., 2013). This suggests that firms must address societal concerns. Despite this call, it is still not clear how the mechanism through which ideas emanating from creativity is translated into innovations. Finally, given that our sample comes from new and small firms, our findings contribute to new venture development by highlighting that green creativity is critical not only in old and large firms but also in new and small ventures. Green creativity has been previously investigated in large firms (Chen et al., 2016; Chen & Chang, 2013; Ogbeibu et al., 2020). However, extant knowledge of the role of green creativity in new ventures is quite limited. Our study indicates that green creativity is important for green product innovation performance in new ventures.

5.2 | Practical implications

This article has two practical contributions. First, managers of new ventures could leverage their green creativity activities to improve green innovation performance through responsible innovation. Our study suggests that green creativity is a relatively effective facilitator of green product innovation performance through responsible innovation. This suggests that green creativity not only overcomes green innovation challenges but also proactively stimulates responsible innovation activities and product innovation outcomes. Therefore, managers in new ventures are advised to invest in green creativity to improve green product innovation outcomes. Second, new ventures need to improve responsible innovation activities for green product innovation performance since there is a mediation between green creativity and green product innovation performance. Given the idea that new products should not damage the health of consumers and the general public, responsible innovation becomes critical for new product development in new ventures. Thus, new processes should be safe for employees and everyone involved, and the new product should not pollute or harm the environment in any way. Third, we find that green creativity has different effects on responsible innovation depending on a firm's resource commitment effort. Therefore, managers in new ventures should be aware that green creativity may not lead to more responsible innovation when a firm commits fewer resources to environmental innovation. It is, therefore, critical for managers to improve resource commitment efforts to enhance the effects of green creativity on responsible innovation.

6 | LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

This study has some limitations that provide new directions for future research. First, the findings of the study are based on a Vietnamese sample that does not address the role of green creativity in green product innovation performance in other contexts. Vietnam has the strong values of a collectivistic culture that offers assertiveness and independence for entrepreneurs to embark on responsible innovation activities. Therefore, the findings must be interpreted based on a collectivistic culture where families and communities have a central role in entrepreneurship. Accordingly, future studies can be conducted using a multi-country setting (e.g., Europe, Latin America, and Africa) to capture the unique and varied contextual idiosyncrasies within which green creativity drives green product innovation performance. Second, green product innovation performance was measured by using self-reported data. Measuring performance in this way may be affected by social desirability bias in responses. Future studies may, therefore, employ triangulated methods to capture actual accounting revenues on product performance in each firm. Finally, the cross-sectional nature of the study precludes us from making causal claims. Given that our dependent variable is performance, a major direction for future research should be the exclusion of a potential endogeneity bias (Hamilton & Nickerson, 2003). Methodologically, researchers could attenuate this problem by utilizing longitudinal data.

Despite these limitations, our results indicate that high levels of green creativity indirectly influence green product innovation performance. The results also show that responsible innovation mediates the relationship between green creativity and green product innovation performance and that these relationships are amplified under greater levels of resource commitment. Overall, the outcomes from this study extend the innovation literature in several ways. In the main, the study contributes to innovation theory development by providing a clearer illustration of the specific conditions in which green creativity positively impacts responsible innovation within a developing economy context.

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