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Beyond Green Intentions: How Green Dynamic Capability and Green Intellectual Capital Drive Environmental Performance

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Abstract

This study examines how green dynamic capability and green intellectual capital shape environmental performance in listed firms. The argument is grounded in dynamic capabilities theory and the natural resource-based view, which together explain that firms need both the ability to adapt and the knowledge base to sustain environmental improvement. The study uses a quantitative approach design and draws on survey responses from top management team members of firms listed on the Indonesia Stock Exchange. The analysis focuses on whether adaptive green capability and environmentally oriented intellectual resources can directly strengthen firm-level environmental performance. The findings indicate that green dynamic capability helps firms improve environmental performance by enabling them to detect environmental change, respond more quickly, and realign operations with green priorities. The results also show that green intellectual capital supports environmental performance by embedding environmental knowledge in people, organizational systems, and external relationships. This study contributes to the literature by offering a clear and focused explanation of how capability renewal and green knowledge resources work as complementary drivers of environmental performance. It also provides practical guidance for executives, sustainability managers, and listed firms that seek to turn environmental commitment into consistent operational outcomes.

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Keywords: green dynamic capability, green intellectual capital, green performance, environmental performance, sustainability management.

INTRODUCTION

Environmental performance has become a central indicator of whether firms can convert sustainability commitments into observable operational outcomes, such as pollution prevention, resource efficiency, waste reduction, and cleaner production practices (Ahmed et al., 2023; Alnaim & Metwally, 2024). In capital markets, environmental performance also functions as a visible signal of corporate responsiveness to regulatory pressure, stakeholder scrutiny, and long-term sustainability expectations (Itan et al., 2025; J. Wang & Zhang, 2026). This issue is particularly important in emerging economies, where firms often face simultaneous pressure to expand competitively while improving environmental accountability and implementation capacity (Taamneh et al., 2026; X. Wang et al., 2024). As a result, environmental performance can no longer be treated as a peripheral compliance outcome, because it increasingly reflects the strategic quality of how firms mobilize internal resources to address environmental change (Franco et al., 2024; Harun et al., 2023).

Dynamic capabilities theory provides an appropriate foundation for explaining why some firms respond to environmental turbulence more effectively than others (Teece, 2007; Teece et al., 1997). The theory argues that firms sustain performance when they can sense emerging shifts, seize suitable opportunities, and transform resource configurations in line with changing external demands (Qiu et al., 2020; Teece, 2007). Within a sustainability context, this logic implies that firms require more than static routines, because environmental challenges are uncertain, cross-functional, and continuously evolving (Harun et al., 2023; Yu et al., 2022). Accordingly, green dynamic capability should help firms renew processes, coordinate green responses, and adjust strategic actions in ways that strengthen environmental outcomes over time (Li et al., 2023; Xing et al., 2020).

At the same time, adaptive capability alone is insufficient if firms lack environmentally valuable knowledge resources that can support sustained action (Hart, 1995; Hart & Dowell, 2011). The natural resource-based view explains that superior environmental outcomes depend on internal resources that are valuable, difficult to imitate, and closely tied to pollution prevention, product stewardship, and sustainable development (Andersén, 2021; Hart, 1995). From this perspective, green intellectual capital represents a critical strategic asset because it embeds environmental knowledge

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in employees, organizational systems, routines, databases, and stakeholder relationships (Asiaei et al., 2023; Begum & Swamy, 2024). When such green knowledge is accumulated and institutionalized, firms are better positioned to design environmental improvements consistently rather than relying on isolated or short-term initiatives (Ramadana et al., 2025; Taamneh et al., 2026).

Although green dynamic capability and green intellectual capital are both widely discussed in sustainability research, the two constructs are often tested in more complex models that emphasize mediation, moderation, or broader sustainability outcomes rather than their direct links with environmental performance (Martínez-Falcó et al., 2025; L. Wang et al., 2025). That stream of research has advanced theory development, but it also leaves room for a more focused explanation of how adaptive green capability and green knowledge resources independently contribute to environmental performance (Asiedu et al., 2025; Prieto et al., 2026). This gap is especially relevant in the context of listed firms, where top management teams must translate environmental intentions into measurable results under conditions of formal governance, stakeholder visibility, and performance pressure (Krisyadi et al., 2025). An empirical assessment centred on respondents from the top management environment of listed firms therefore offers a meaningful setting for testing whether dynamic adaptation and green knowledge assets each matter for environmental performance (Itan et al., 2025; Ramadana et al., 2025).

Accordingly, this study examines the direct effects of green dynamic capability and green intellectual capital on environmental performance. The study contributes to theory by integrating dynamic capabilities theory and the natural resource-based view within a parsimonious model that distinguishes the role of adaptive green capability from the role of strategic green knowledge resources (Hart & Dowell, 2011; Teece, 2007). The study also contributes empirically by providing evidence from respondents situated in the top-management context of listed firms, where environmental decisions are closely linked to governance visibility, strategic accountability, and organizational resource allocation (Itan et al., 2025). Finally, the study contributes practically by showing managers and decision makers that stronger environmental performance requires both the capability to reconfigure green actions and the intellectual resource base needed to sustain those actions across the organization (Alnaim & Metwally, 2024; Franco et al., 2024). These contributions are consistent with the later sections of the article, which test the proposed relationships quantitatively, interpret the results in light of the two guiding theories, and derive implications for firms seeking more credible environmental improvement (Hair et al., 2019; Harun et al., 2023).

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LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Dynamic capabilities theory explains how firms sustain performance under changing conditions by sensing opportunities and threats, seizing promising responses, and transforming resource configurations over time (Teece, 2007; Teece et al., 1997). The theory is especially relevant to sustainability because environmental challenges are cumulative, regulation is evolving, and stakeholder expectations are increasingly volatile, which requires continuous organizational renewal rather than one-off adaptation (Franco et al., 2024; Harun et al., 2023). In this study, green dynamic capability is treated as a higher-order organizational capacity that helps firms integrate environmental knowledge, redesign routines, and align strategic action with ecological demands (Asiedu et al., 2025; Li et al., 2023).

The natural resource-based view (NRBV) complements this logic by explaining why environmental performance also depends on the quality of internal green resources and capabilities that firms accumulate and deploy (Hart, 1995; Hart & Dowell, 2011). NRBV argues that pollution prevention, product stewardship, and sustainability-oriented development become strategic when firms build rare, valuable, and organization-specific environmental resources that rivals cannot easily replicate (Andersén, 2021; Hart, 1995). Within that logic, green intellectual capital represents a portfolio of green human, structural, and relational capital that strengthens a firm's ability to convert environmental intent into coordinated managerial and operational action (Alnaim & Metwally, 2024; Asiaei et al., 2023).

Green Dynamic Capability and Environmental Performance

Dynamic capabilities theory predicts that firms with stronger green dynamic capability should achieve superior environmental performance because they can identify environmental shifts earlier, mobilize responses faster, and reconfigure processes more effectively than less adaptive firms (Harun et al., 2023; Teece, 2007). Green dynamic capability enables firms to combine environmental sensing, green opportunity recognition, and resource reconfiguration into concrete operational responses such as cleaner processes, greener products, and more disciplined environmental execution (Qiu et al., 2020; Zhang et al., 2020). Recent evidence shows that green dynamic capability supports environmental and social innovation behavior and strengthens sustainability-oriented outcomes when firms face ecological complexity and competitive pressure (Asiedu et al., 2025; Li et al., 2023). Other studies likewise indicate that green dynamic capability helps firms connect environmental regulation, innovation, and performance by

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improving organizational agility and the ability to renew resource bases under uncertainty (Franco et al., 2024; Xing et al., 2020). In the context of listed firms, this capability should be particularly important because environmental performance depends not only on policy compliance but also on timely managerial coordination across functions, business units, and external stakeholders (Harun et al., 2023; L. Wang et al., 2025). Therefore, firms with stronger green dynamic capability are expected to report better environmental performance.

H1: Green dynamic capability has a positive effect on environmental performance.

Green Intellectual Capital and Environmental Performance

From the natural resource-based view, environmental performance improves when firms possess environmentally valuable knowledge resources that are embedded in people, systems, routines, and stakeholder relationships (Hart, 1995; Hart & Dowell, 2011). Green intellectual capital captures this logic because green human capital supports problem solving, green structural capital stabilizes environmental routines, and green relational capital strengthens collaboration with external stakeholders and knowledge partners (Asiaei et al., 2023; Taamneh et al., 2026). Empirical studies show that green intellectual capital improves environmental performance by enhancing a firm's ability to absorb sustainability knowledge, coordinate environmental initiatives, and institutionalize green practices across operations (Alnaim & Metwally, 2024; Begum & Swamy, 2024). Related evidence also suggests that firms with stronger green intellectual capital are better positioned to generate green innovation and translate environmental resources into measurable ecological outcomes (Asiaei et al., 2023; Ramadana et al., 2025). In capital-market settings, these knowledge-based green assets should matter because listed firms are expected to formalize environmental governance, document environmental processes, and maintain credible engagement with regulators, investors, and supply-chain partners (Alnaim & Metwally, 2024; Taamneh et al., 2026). Therefore, firms with stronger green intellectual capital are expected to demonstrate better environmental performance.

H2: Green intellectual capital has a positive effect on environmental performance.

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Figure 1 presents the research model examined in this study.

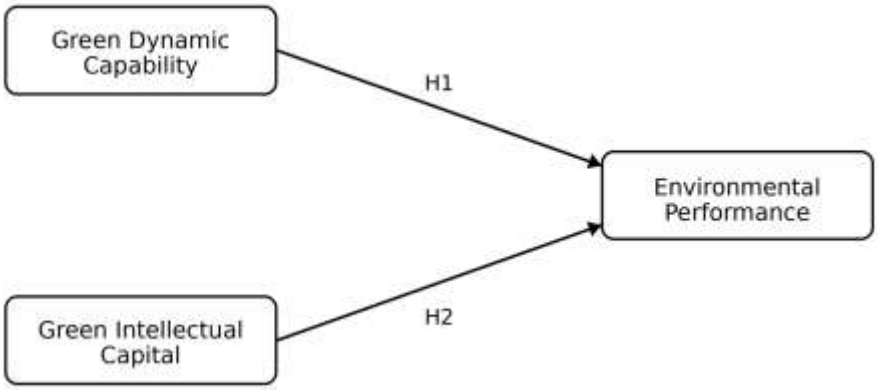


Figure 1: Research Model

RESEARCH METHODOLOGY

Data Collection and Procedure

This study employed a quantitative approach design to test the hypotheses derived from dynamic capabilities theory and the natural resource-based view. This study evaluates theoretically specified direct relationships between green dynamic capability, green intellectual capital, and environmental performance.

The population comprised top management team (TMT) members from firms listed on the Indonesia Stock Exchange (IDX). TMT respondents were selected because they are directly involved in strategic decision-making, organizational resource allocation, sustainability direction, and environmental governance (Franco et al., 2024). Data were collected through a structured questionnaire distributed to respondents who met the managerial and organizational criteria established for this study.

A total of 218 usable responses were retained for analysis after the screening process. The final sample reflects the characteristics of listed-firm decision makers across gender, age group, education level, and position. Table 1 presents the demographic profile of the respondents and shows that the sample is dominated by respondents aged 29-44 years, with postgraduate educational backgrounds and managerial roles that are relevant to corporate sustainability decisions.

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Table 1: Demographic Details

Criteria	Number of Respondents	Percentage
Respondent gender		
Female	161	77%
Male	47	23%
Respondent age		
Under 29 years	8	4%
29 – 44 years	157	75%
45 – 60 years	35	17%
Over 60 years	8	4%
Respondent education level		
Bachelor (S1)	92	44%
Master (S2)	103	50%
Doctorate (S3)	13	6%
Position of respondents		
Commissioner	5	2%
President Director / CEO	2	1%
Director	27	13%
Manager	154	74%
ESG/Sustainability Committee	20	10%
Main functional area of respondents		
Business Development	31	15%
Operations	50	24%
Marketing	10	5%
Finance	33	16%
ESG/Sustainability	44	21%
Internal Audit	5	2%
Human Resources	10	5%
IT and Infrastructure	11	5%
Research and Development	14	7%
Total	**208**	**100%**

Source(s): Authors' own work (2026)

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Table 1 shows that the respondents were predominantly female (77%), aged 29-44 years (75%), held a master's degree (50%), and mostly occupied managerial positions (74%). The profile suggests that the dataset is dominated by respondents who are in an active career stage and are likely to be directly involved in strategic and operational decision-making. This composition strengthens the credibility of the responses because environmental capability development and environmental performance are often shaped by managerial actors who coordinate across functions.

Measurement and Validation

All constructs were operationalized as reflective latent variables and measured with multi-item indicators adopted from prior studies. Environmental performance was defined as the firm's ability to reduce pollution, waste, hazardous material use, resource consumption, and environmental incidents, which makes it an appropriate outcome indicator of organizational sustainability efforts (Anvarjonov et al., 2024). Green dynamic capability was defined as the firm's ability to sense environmental change, seize green opportunities, and reconfigure resources, knowledge, and processes in response to sustainability demands (Qiu et al., 2020; Singh et al., 2022; Teece, 2007; Teece et al., 1997). Green intellectual capital was defined as environmentally oriented human, structural, and relational knowledge assets that support innovation, stakeholder collaboration, and long-term environmental improvement (Chen, 2008; López-Gamero et al., 2011; Martínez-Falcó et al., 2024; Yong et al., 2023; Yusliza et al., 2020). The questionnaire was reviewed to ensure conceptual clarity, indicator relevance, and wording consistency with the context of listed firms, and all responses were captured on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Table 2 presents the integrated measurement items for all variables used in this study.

Table 2: Integrated Measurement Items of Study Variables

Variable	Code	Indicator	Source
Environmental Performance (ENP)	ENP1	The company consistently implements efforts to reduce environmental pollution levels.	Anvarjonov et al. (2024)
	ENP2	The company reduces waste and emissions, including air emissions, wastewater, and solid waste.	

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Variable	Code	Indicator	Source
	ENP3	The company seeks to minimize the negative environmental impact of its products.	
	ENP4	The company reduces the use of materials that are hazardous, toxic, or harmful to the environment.	
	ENP5	The company improves efficiency by reducing energy consumption and the use of materials.	
	ENP6	The company reduces the frequency of environmental accidents or incidents in its operational area.	
Green Dynamic Capability (GDC)	GDC1	The company has the capability to monitor the environment quickly in order to identify green opportunities.	Xiaoyi et al. (2023)
	GDC2	The company has the capability to assimilate, learn, generate, combine, share, transform, and apply green knowledge.	
	GDC3	The company has the capability to successfully integrate and manage specialized green knowledge within the company.	
	GDC4	The company has the capability to successfully coordinate employees in developing green technology.	
	GDC5	The company has the capability to successfully allocate resources to develop green innovation.	
Green Intellectual Capital (GIC)	GIC1	Company employees are concerned about environmental issues in carrying out their work.	Martínez-Falcó et al. (2024)

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Variable	Code	Indicator	Source
	GIC2	Company employees possess adequate knowledge and skills to protect the environment.	
	GIC3	Company employees actively work together in teams to address environmental issues.	
	GIC4	Company employees collaborate with suppliers in efforts to protect the environment.	
	GIC5	Company employees collaborate with customers or distributors to maintain environmental sustainability.	
	GIC6	The company implements innovations that support environmental protection.	
	GIC7	The company invests in facilities and infrastructure to support environmental protection efforts.	

Source(s): Adapted from Anvarjonov et al. (2024), Xiaoyi et al. (2023), and Martínez-Falcó et al. (2024)

Data Analysis Technique

The data were analysed using covariance-based structural equation modelling (CB-SEM) in AMOS. This technique is appropriate because the study tests a theoretically specified measurement model and a direct-effects structural model with reflective indicators. Following established SEM practice, the analysis proceeded through descriptive profiling, confirmatory factor assessment, construct validity and reliability evaluation, and hypothesis testing based on standardized estimates, critical ratios, and probability values.

RESEARCH AND RESULTS

Table 3 reports the descriptive statistics of the variables. The mean score for green dynamic capability is 3.002, the mean score for green intellectual capital is 3.058, and the mean score for environmental performance is 3.035. These averages are slightly above

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the midpoint of the scale, indicating that the sampled firms demonstrate a moderate tendency to develop green capabilities, accumulate green knowledge assets, and report environmental improvement. The pattern is also meaningful because it suggests that environmental management is present in these firms, although there remains substantial room for strengthening both capability depth and implementation consistency.

Table 3: Descriptive Statistics of Variables

Variable	Mean
Green Dynamic Capability	3.002
Green Intellectual Capital	3.058
Environmental Performance	3.035

Source(s): Authors' own work (2026)

Table 4 presents the validity test results. All indicators exceed the commonly accepted loading threshold, and each construct records an average variance extracted value above 0.50.

Table 4: Validity Test Results

Variable	Indicator	Estimate	AVE	Validity
Green Dynamic Capability	GDC1	0.796	0.659	**Valid**
	GDC2	0.793		**Valid**
	GDC3	0.825		**Valid**
	GDC4	0.833		**Valid**
	GDC5	0.812		**Valid**
Green Intellectual Capital	GIC1	0.838	0.683	**Valid**
	GIC2	0.842		**Valid**
	GIC3	0.832		**Valid**
	GIC4	0.807		**Valid**
	GIC5	0.800		**Valid**
	GIC6	0.844		**Valid**
	GIC7	0.823		**Valid**
	ENP1	0.914	0.800	**Valid**
	ENP2	0.906		**Valid**

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Environmental Performance	ENP3	0.887		**Valid**
	ENP4	0.912		**Valid**
	ENP5	0.883		**Valid**
	ENP6	0.864		**Valid**

Source(s): Authors' own work (2026)

These results indicate that the indicators capture their intended latent constructs with acceptable convergent validity. In other words, the measurement items for green dynamic capability, green intellectual capital, and environmental performance are sufficiently representative of the concepts examined in this study.

Table 5 shows that all constructs demonstrate strong composite reliability, namely 0.906 for green dynamic capability, 0.938 for green intellectual capital, and 0.960 for environmental performance. These values indicate high internal consistency among the indicators used to measure each construct. The reliability evidence strengthens confidence that the observed responses provide a stable basis for testing the structural relationships proposed in the model.

Table 5: Reliability Test Results

Variable	Composite Reliability (CR)
Green Dynamic Capability	0.906
Green Intellectual Capital	0.938
Environmental Performance	0.960

Source(s): Authors' own work (2026)

Table 6 reports the hypothesis test results and shows that both hypotheses are supported. Green dynamic capability has a positive and significant effect on environmental performance. Green intellectual capital also has a positive and significant effect on environmental performance. The structural results therefore confirm that both adaptive green capability and knowledge-based green resources are important antecedents of environmental outcomes in the sampled firms.

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Table 6: Hypothesis Test Results

Hypothesis		Estimate	C.R.	p-value	Conclusion
H1	Green dynamic capability has a positive effect on environmental performance	0.578	5.980	***	**Supported**
H2	Green intellectual capital has a positive effect on environmental performance	0.543	6.260	***	**Supported**

Source(s): Authors' own work (2026)

The results in Table 6 show that green dynamic capability has a positive and significant effect on environmental performance. Accordingly, H1 is supported. This finding is consistent with dynamic capabilities theory, which argues that firms achieve better outcomes when they are able to sense change, seize opportunities, and reconfigure resources in response to evolving environmental demands (Qiu et al., 2020). The result indicates that environmental performance is not strengthened merely by having environmental intentions; it improves when firms can continuously realign routines, technologies, and managerial processes with ecological requirements. This interpretation is in line with prior evidence showing that green dynamic capability supports sustainability improvement and environmentally oriented innovation behavior (Asiedu et al., 2025; Li et al., 2023). It also resonates with the argument of Haug et al. (2025), who emphasize that green dynamic capabilities help firms navigate sustainability change through adaptive renewal rather than static compliance. In the context of managerial respondents from listed-firm settings, the result can be explained by the strategic role of top management teams. Environmental initiatives in listed firms usually involve multiple functions, including operations, compliance, finance, and sustainability reporting. When managers are able to coordinate those functions and reconfigure resources quickly, environmental performance is more likely to improve in a measurable way. Practically, firms should invest not only in environmental programs, but also in the managerial routines, coordination mechanisms, and resource-reconfiguration processes that allow those programs to evolve as conditions change.

The results in Table 6 show that green intellectual capital has a positive and significant effect on environmental performance. Therefore, H2 is supported. This finding is consistent with the natural resource-based view, which maintains that environmentally valuable knowledge assets can become strategic resources when they support pollution prevention, operational efficiency, and sustainable development (Andersén, 2021). The result suggests that firms are more likely to achieve stronger environmental performance

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when green knowledge is embedded in employee competence, organizational systems, and relational networks. This interpretation is consistent with prior studies reporting that green intellectual capital improves environmental outcomes by strengthening learning, green process refinement, and sustainability-oriented execution (Asiaei et al., 2023; Taamneh et al., 2026). It is also aligned with the more recent evidence of Alnaim and Metwally (2024) and Ramadana et al. (2025), who show that green intellectual capital plays an important role in converting environmental commitment into measurable performance gains. For managerial respondents in listed-firm settings, this result is plausible because environmental commitments require more than symbolic support from leaders. They also require codified systems, data, expertise, and organizational memory that can guide implementation across units. When top management teams operate in firms with stronger green intellectual capital, they are better equipped to transform environmental goals into consistent action, monitoring, and improvement. Practically, this means that firms should treat green training, knowledge systems, sustainability databases, and environmentally oriented stakeholder relationships as strategic investments rather than as supporting accessories.

CONCLUSION AND RECOMMENDATIONS

This study concludes that both green dynamic capability and green intellectual capital are significant antecedents of environmental performance. The first finding shows that firms improve environmental outcomes when they are able to renew and reconfigure green-related resources and routines in response to changing ecological demands. The second finding shows that environmental performance also depends on the strength of the firm's green knowledge assets, including human expertise, organizational systems, and relational resources. Taken together, the results demonstrate that environmental performance is more likely to improve when adaptive capability and green intellectual resources operate in a complementary manner.

Theoretically, the article contributes to dynamic capabilities theory by showing that environmental performance is shaped by the firm's capacity for ongoing green reconfiguration. It also contributes to the natural resource-based view by demonstrating that green intellectual capital functions as a strategically valuable resource base for environmental improvement. Practically, the findings are relevant for top management teams, sustainability managers, human resource leaders, and corporate policy makers in listed firms. Top management teams should strengthen cross-functional resource reconfiguration and strategic responsiveness. Sustainability managers should

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institutionalize environmental learning and monitoring systems. Human resource leaders should expand green training and competence development. Corporate policy makers should treat knowledge-based sustainability infrastructure as a core strategic asset rather than a peripheral support function.

This study is subject to several limitations. It relies on cross-sectional survey data, which limits causal inference. It also focuses on direct relationships, so it does not capture mediating or moderating mechanisms that may explain how or when these effects become stronger. In addition, the evidence is drawn from managerial respondents in a single national setting, which may restrict generalizability across countries and industries. Future research could address these limitations by using longitudinal designs, multi-country samples, and extended models that incorporate mediators such as green innovation capability or moderators such as environmental dynamism and regulatory pressure.

Theoretical and practical implications, limitations, and future research. Beyond the main conclusion, the study reinforces a simple but important message: environmental performance improves when firms combine the ability to adapt with the knowledge infrastructure required to sustain that adaptation. For scholars, this means that dynamic capabilities theory and NRBV should not be treated as competing lenses in this context. They are complementary. For practitioners, especially executives in listed firms, the findings highlight that sustainability performance is built through repeated organizational learning, systematized knowledge, and coordinated managerial action rather than through isolated environmental initiatives.

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