

How Green Organizational Culture Translates into Business Performance: The Mediating Roles of Business and Technology Driven Eco Innovative Capabilities

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ABSTRACT

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Research aims: This study examines how green organisational culture (GOC) is translated into financial and non-financial business performance through business-driven and technology-driven eco-innovative capabilities (EIC). Specifically, it assesses the influence of GOC on both EIC dimensions, compares their effects on financial and non-financial performance, and examines their mediating roles in the GOC-performance relationship.

Design/methodology/approach: The study adopts a quantitative cross-sectional design. Survey data were collected from 58 top- and middle-level managers serving as key informants for Malaysian manufacturing and service firms registered with the Sustainable Energy Development Authority Malaysia (SEDA Malaysia) and engaged in environmental and sustainability-related practices. The proposed relationships were analysed using partial least squares structural equation modelling (PLS-SEM).

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Theoretical contribution/Originality: Drawing on the Resource-Based View (RBV), the study demonstrates that the performance relevance of GOC varies according to the capability through which it is deployed. Business-driven EIC enhances non-financial performance but shows no significant effect on financial performance, whereas technology-driven EIC enhances both financial and non-financial performance. The mediation effects are therefore path-specific. The study extends RBV by distinguishing between different eco-innovative capability pathways and showing that capabilities originating from the same cultural resource may generate different forms of performance value.

Practitioner/Policy implications: The findings suggest that managers should align eco-innovation investments with the performance outcomes they seek. Technology-driven initiatives are particularly relevant when financial and operational outcomes are priorities, while business-driven initiatives contribute more strongly to reputation, competitive positioning, and other non-financial outcomes. Policymakers can support firms through incentives, knowledge transfer, and collaboration initiatives that facilitate the development and adoption of eco-innovative capabilities.

Keywords: Green Organisational Culture, Eco-Innovative Capability, Technology, Business, Financial, Non-Financial

JEL Classification: M14, O32, Q55, L25

1. Introduction

Growing environmental challenges and global sustainability demands have increased pressure on businesses to reduce ecological harm while remaining competitive (Afum et al., 2020; Al-Hakimi et al., 2022; Qu et al., 2022). Malaysian manufacturing and service firms encounter these pressures through production processes, service-delivery systems, supply chains, stakeholder expectations, and market positioning. Eco-innovative capability is therefore particularly important because it enables firms to convert environmental commitments into resource-efficient operations, greener products and services, and credible market differentiation. Rather than treating sustainability as a compliance exercise, firms must develop the capacity to redesign operations, products, and strategies in ways that support environmental goals and business continuity (Engelmann & Al-Saidi, 2019; Valdez-Juárez & Castillo-Vergara, 2021; Zulkiffli et al., 2022). Prior evidence from the Malaysian technology industry further indicates that eco-innovation practices are associated with sustainable business performance under varying market conditions (Ch'ng et al., 2021). Eco-innovative capability refers to a firm's ability to design, adopt, and implement innovations that reduce negative environmental impacts while supporting business growth (Sharma et

al., 2021; Al-Hakimi et al., 2022). It can be categorised into technology-driven and business-driven capabilities (Engelmann & Al-Saidi, 2019; Pichlak, 2021). These categories are theoretically meaningful because they represent two distinct resource-deployment pathways under RBV. Technology-driven EIC embeds environmental values in processes, equipment, and technical systems to reduce emissions, save energy, and optimise resource use (Pichlak, 2021; Valdez-Juárez & Castillo-Vergara, 2021). Business-driven EIC deploys those values through products, marketing, supply chains, business models, and managerial practices (Engelmann & Al-Saidi, 2019). The former primarily targets operational efficiency and resource productivity, whereas the latter targets market acceptance, stakeholder legitimacy, and business-model renewal. Distinguishing them therefore permits a more precise assessment of how different capabilities create different forms of value.

Past research suggests that firms with higher eco-innovative capability often experience better financial and non-financial performance (Roscoe et al., 2019; Ben Amara & Chen, 2021). Financially, eco-innovations can reduce operating costs, open new market opportunities, and improve long-term profitability (Valdez-Juárez & Castillo-Vergara, 2021; Zulkiffli et al., 2022). Non-financial performance includes enhanced corporate reputation, better stakeholder relationships, and greater employee engagement (Al-Hakimi et al., 2022). These benefits highlight the strategic importance of eco-innovation as a driver of sustainable competitive advantage. However, building eco-innovative capability is not only a technical or resource-based issue, but also requires a conducive internal environment that fosters sustainability-oriented thinking and behaviour.

In this regard, a strong green organisational culture (GOC) plays an enabling rather than automatically performance-enhancing role (Sharma et al., 2021). GOC refers to the shared values and norms within a company that promote environmentally responsible behaviour (Aggarwal and Agarwala, 2021). It shapes managerial priorities, employee behaviour, and organisational routines that support green policies, eco-friendly decision-making, and innovation (Al-Swidi et al., 2021; Al-Hakimi et al., 2022; Abbas & Khan, 2022; Qu et al., 2022; Shahriari et al., 2023; Subramanian & Suresh, 2023). From an RBV perspective, GOC is an intangible strategic resource, but its performance value depends on whether firms convert shared green values into business- and technology-driven capabilities.

Despite these insights, three related gaps remain. First, most studies focus on the direct effects of GOC or eco-innovation on

environmental or corporate sustainability outcomes (Ben Amara & Chen, 2021; Al-Hakimi et al., 2022), leaving the organisational mechanism that converts a green cultural resource into financial and non-financial performance insufficiently explained. This matters theoretically because a direct resource–performance link does not show how GOC becomes economically valuable. Second, prior research frequently treats eco-innovation as a single construct rather than distinguishing business-driven and technology-driven capabilities (Engelmann & Al-Saidi, 2019; Pichlak, 2021). This matters practically because managers may misallocate resources if they assume that all eco-innovations produce the same outcomes. Third, although GOC is recognised as an antecedent of green action, limited research has examined its role in building distinct eco-innovative capabilities that subsequently influence performance (Ben Amara & Chen, 2021; Al-Hakimi et al., 2022).

These gaps are especially relevant in an emerging-economy setting in which manufacturing and service firms face different technological requirements, customer expectations, and resource constraints. The same green culture may therefore produce different outcomes depending on the capability developed. Examining business-driven and technology-driven EIC as separate mediating mechanisms clarifies why GOC alone may not guarantee improved performance and identifies the specific pathways through which it becomes performance-relevant.

To address these limitations and provide a more precise understanding of the relationships among these constructs, this study is guided by the following research questions:

- RQ1: Does green organisational culture influence business-driven and technology-driven eco-innovative capabilities?
- RQ2: Do business-driven and technology-driven eco-innovative capabilities affect financial and non-financial business performance?
- RQ3: How do business-driven and technology-driven eco-innovative capabilities mediate the relationship between green organisational culture and business performance?

The corresponding research objectives are to: (1) assess the influence of GOC on business-driven and technology-driven EIC; (2) compare the effects of both EIC dimensions on financial and non-financial performance; and (3) test the specific indirect paths linking GOC to each performance dimension through each form of EIC. These objectives are examined using data from Malaysian

manufacturing and service firms engaged in environmental and sustainability-related practices.

This study contributes to the literature in two ways. First, it refines RBV by showing that a green cultural resource creates performance value through specific organisational capabilities rather than through a uniform direct effect. Second, it disaggregates EIC and shows that capability type shapes the form of performance value generated. This distinction is practically relevant for Malaysian firms because it indicates whether investments should target operational technologies or market- and business-oriented initiatives depending on the performance outcomes sought.

2. Literature Review

2.1 *Theoretical Underpinning*

This study draws on the Resource-Based View (RBV) (Barney, 1991) to examine how green organisational culture (GOC) influences business performance (BP). Under RBV, GOC can possess the attributes required for strategic value. It is valuable because it coordinates environmentally responsible decisions and reduces internal resistance to sustainability initiatives; rare because the depth and consistency of green values vary across firms; difficult to imitate because it develops through path-dependent leadership, shared experience, and embedded routines; and non-substitutable because formal policies or isolated technologies cannot fully replace shared environmental norms (Aggarwal & Agarwala, 2021; Abbas & Khan, 2022; Al-Hakimi et al., 2022; Subramanian & Suresh, 2023). Nevertheless, possession of this cultural resource alone does not ensure superior performance.

RBV distinguishes resources from capabilities: resources provide potential value, whereas capabilities are repeatable organisational abilities to deploy resources toward desired outcomes. EIC is therefore a capability rather than merely a resource because it reflects coordinated patterns of managerial commitment, employee knowledge, green routines, cross-functional planning, and technological investment. Through these mechanisms, GOC influences what employees prioritise, how managers allocate resources, and which environmental ideas are converted into products, processes, and business models. EIC operationalises GOC by translating shared values into observable actions that can reduce costs, improve market legitimacy, and strengthen performance (Fok et al., 2022; Subramanian & Suresh, 2023).

2.2 *Green Organisational Culture*

Green organisational culture (GOC) refers to a set of assumptions, values, and practices that demonstrate an organisation's commitment to environmentally sustainable operations (Abbas & Khan, 2022). It involves adopting green practices and transitioning toward a culture that is more environmentally conscious (Aggarwal & Agarwala, 2021). GOC is reflected through symbols and actions that convey a firm's dedication to promoting environmental sustainability (Al-Hakimi et al., 2022). It fosters a culture where employees are encouraged to adopt pro-environmental attitudes and where the organisational climate supports the generation of innovative ideas and processes that minimise environmental harm (Subramanian & Suresh, 2023). According to Abbas & Khan (2022), GOC ensures that environmental concerns are embedded as core drivers of green innovation across all organisational levels. Evidence shows that GOC contributes to enhanced organisational productivity (Al-Swidi et al., 2021; Al-Hakimi et al., 2022), improved corporate reputation (Abbas & Khan, 2022; Al-Hakimi et al., 2022), stronger innovation capabilities (Qu et al., 2022; Shahriari et al., 2023), and a sustained competitive advantage (Qu et al., 2022; Subramanian & Suresh, 2023).

From an RBV perspective, GOC represents a potentially valuable, rare, and difficult-to-imitate resource; however, its impact on performance is expected to operate through capabilities and routines. Prior evidence indicates that green values shape employee behaviour, managerial commitment, innovation routines, and the adoption of environmentally oriented practices, which then influence organisational outcomes (Qu et al., 2022; Abbas & Khan, 2022; Al-Hakimi et al., 2022; Subramanian & Suresh, 2023). Thus, culture provides direction and motivation, while capabilities provide the coordinated means of implementation.

2.3 *Eco-Innovative Capability (EIC)*

Eco-innovative capability (EIC) refers to a firm's ability to develop new or improved products and processes that both deliver customer value and reduce environmental harm (Cheng et al., 2014). This capability reflects a continuous pursuit of radical innovation aimed at enhancing environmental sustainability and lowering ecological risks (Scarpellini et al., 2018). A firm demonstrates EIC when it possesses the resources to proactively improve environmental management through its operations (Kuo et al., 2022). EIC involves innovations that not only generate income but also mitigate environmental risks

and deliver measurable economic and social benefits (Munodawafa & Johl, 2022; Larbi-Siaw et al., 2023). Through the development and promotion of green products and processes, eco-innovation offers a way for firms to contribute to environmental stewardship while shaping public perceptions of corporate responsibility (Kuo et al., 2022; Munodawafa & Johl, 2022; Larbi-Siaw et al., 2023). Firms with strong EIC go beyond offering new products by integrating advanced and environmentally friendly technologies (Kuo et al., 2022).

Cheng et al. (2014) advocate a holistic eco-innovation strategy that encompasses both technological change and changes in business and management systems. Consistent with this view, technology-driven EIC captures the firm's patterned ability to embed environmental priorities in production or service processes, equipment, and technical systems. Business-driven EIC captures the ability to embed those priorities in products, markets, supply chains, managerial systems, and business models. The distinction is theoretically important because the two capabilities deploy the same green cultural resource through different mechanisms and may therefore generate different financial and non-financial outcomes.

Scholars often distinguish between internal and external dimensions of EIC. External EIC relates to support from outside sources such as suppliers, regulators, and industry associations (Cheng et al., 2014; Scarpellini et al., 2018; Ch'ng et al., 2021), while internal EIC refers to innovation within the firm through new business models, product designs, and production or service methods (Cheng et al., 2014; Almeida & Wasim, 2023). This study focuses on internal eco-innovative capability, as it reflects firm-specific capabilities that are directly shaped by organisational culture and managerial practices.

2.4 Business Performance

Business performance (BP) captures how organisational resources interact with external conditions to influence both financial and non-financial outcomes (Abbas & Khan, 2022; Al-Hakimi et al., 2022). It provides essential feedback on whether a firm is achieving its objectives and informs corrective actions where necessary (Al-Hakimi et al., 2022). Financial performance (FP) is commonly assessed using metrics such as profit margins, sales and revenue growth, return on investment, return on equity, and operating cash flow (Agyabeng-Mensah et al., 2020; Al-Hakimi et al., 2022; Imran & Jingzu, 2022). Non-financial performance (NFP) includes indicators such as customer satisfaction, loyalty, corporate reputation, innovation,

competitive advantage, ESG (environmental, social, and governance) performance, and employee satisfaction (Al-Swidi et al., 2021; Abbas & Khan, 2022; Al-Hakimi et al., 2022; Imran & Jingzu, 2022).

From an RBV perspective, business performance represents the outcome of effectively leveraging organisational resources and capabilities, where intangible resources such as GOC and capabilities such as EIC jointly contribute to sustained competitive advantage. Together, these dimensions provide a comprehensive understanding of organisational success.

3. Hypotheses Development

3.1 *Green Organisational Culture (GOC) and Eco-Innovative Capabilities (EIC)*

Empirical research indicates that GOC nurtures employee creativity and initiative by making environmental responsibility a legitimate organisational priority (Qu et al., 2022). It shapes the values used in decision-making, encourages managerial support for green ideas, and creates routines through which employees identify and implement environmentally oriented opportunities. From an RBV perspective, these shared values constitute an intangible resource that supports the development of firm-specific capabilities rather than producing performance automatically.

The business-driven pathway arises when GOC encourages managers and employees to integrate environmental priorities into green marketing, eco-product development, customer engagement, supply-chain choices, and sustainable business models. The technology-driven pathway arises when GOC legitimises investment in cleaner technologies, green processes, process redesign, energy efficiency, pollution prevention, and eco-production or eco-service systems. Prior studies show that environmental commitment supports both market-facing and operational forms of eco-innovation (García-Granero et al., 2020; Ch'ng et al., 2021; Abbas & Khan, 2022; Al-Hakimi et al., 2022). Accordingly, the following hypotheses are proposed:

H_1 : GOC is positively associated with a firm's business-driven eco-innovative capability.

H_2 : GOC is positively associated with a firm's technology-driven eco-innovative capability.

3.2 *Eco-Innovative Capabilities (EIC) and Business Performance (BP)*

The literature on the relationship between EIC and BP presents mixed findings. One perspective argues that eco-innovation entails high costs and may reduce firm profitability and other financial outcomes (Driessen et al., 2013). These arguments often highlight tensions between eco-innovation investments and the shareholder wealth maximisation principle. However, a contrasting body of research finds that EIC can enhance business performance, especially in contexts where stakeholder concerns and legitimacy pressures encourage sustainable practices (Alos-Simo et al., 2020; Ben Amara & Chen, 2021). From an RBV standpoint, eco-innovative capability represents a strategic capability that enables firms to transform environmental initiatives into performance outcomes by improving operational efficiency, reducing costs, and enhancing market positioning.

Proponents of EIC emphasise that investments in environmentally innovative practices lead to better business strategies and technologies that reduce environmental damage while strengthening competitive positioning (Ben Amara & Chen, 2021; Kuo et al., 2022; Ch'ng et al., 2021). These capabilities can lower production costs, improve customer satisfaction, and boost reputation, all of which contribute to financial and non-financial gains (Scarpellini et al., 2018; Ben Amara & Chen, 2021).

Importantly, the impact of eco-innovation on performance may vary by capability type. Technology-driven EIC is directly connected to process efficiency, resource productivity, and cost reduction. Business-driven EIC may improve financial outcomes through green products, market differentiation, and new business models, but this relationship may be weaker or context-dependent because returns depend on customer willingness to pay, market maturity, implementation costs, and the firm's ability to monetise sustainability claims. Business-driven EIC is nevertheless expected to strengthen non-financial outcomes through reputation, customer satisfaction, and competitive positioning (Ben Amara & Chen, 2021; Kuo et al., 2022; Ch'ng et al., 2021). Based on these arguments, the following hypotheses are proposed:

H_{3a} : Business-driven EIC is positively associated with FP.

H_{4a} : Business-driven EIC is positively associated with NFP.

H_{5a} : Technology-driven EIC is positively associated with FP.

H_{6a} : Technology-driven EIC is positively associated with NFP

3.3 *The Mediating Effect of Eco-Innovative Capabilities (EIC)*

Green organisational culture (GOC) encourages environmentally responsible corporate behaviour by promoting the production and delivery of eco-friendly products and services (Al-Swidi et al., 2021; Abbas & Khan, 2022; Al-Hakimi et al., 2022; Imran & Jingzu, 2022). Firms are considered to embody a green culture when environmental sustainability goals go beyond profit motives and are embedded into their core values and strategies (Abbas & Khan, 2022; Al-Hakimi et al., 2022; Imran & Jingzu, 2022). GOC helps employees better understand environmental issues, thereby enhancing the implementation of robust environmental initiatives and aligning sustainability objectives with financial performance (Al-Swidi et al., 2021; Abbas & Khan, 2022; Al-Hakimi et al., 2022). Additionally, GOC-driven firms tend to attract socially responsible investors, especially under the growing influence of socially responsible investment (SRI) practices, by transparently disclosing their environmental impacts (Afum et al., 2020; Imran & Jingzu, 2022).

GOC is seen as a valuable, rare, and inimitable resource that enables firms to differentiate themselves by offering eco-friendly products, gaining competitive advantage, and improving financial and reputational outcomes (Agyabeng-Mensah et al., 2020; Afum et al., 2020; Imran & Jingzu, 2022). In particular, firms with strong GOC tend to institutionalise sustainability across functions, which strengthens their brand image and credibility among stakeholders (Agyabeng-Mensah et al., 2020; Abbas & Khan, 2022; Al-Hakimi et al., 2022). However, consistent with RBV, resources such as GOC do not directly generate performance outcomes unless they are transformed into firm-specific capabilities. While GOC sets the cultural foundation, it does not directly translate into performance unless firms develop internal capabilities that operationalise their environmental values.

A strong GOC cultivates employees who embed eco-conscious practices into daily operations (Al-Swidi et al., 2021). Subramanian & Suresh (2023) explain that GOC allows firms to revise their operations through the adoption of eco-innovative ideas and systems. In this regard, eco-innovative capability serves as the key mechanism through which GOC is translated into measurable business outcomes.

Drawing on RBV, GOC raises environmental awareness and directs managerial and employee attention toward eco-innovative

action (Al-Hakimi et al., 2022). EIC is therefore the mediating mechanism—not simply a parallel resource—through which GOC becomes performance-relevant. Business-driven EIC converts green values into market-facing products, services, and business practices, while technology-driven EIC converts them into cleaner technologies, processes, and operational systems. These capability pathways can subsequently influence financial and non-financial performance. Accordingly, the following mediation hypotheses are proposed:

H_{3b} : Business-driven EIC mediates the relationship between GOC and FP.

H_{4b} : Business-driven EIC mediates the relationship between GOC and NFP.

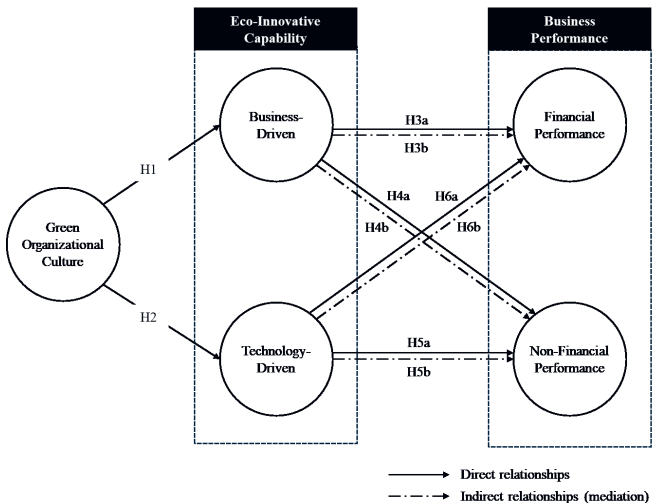
H_{5b} : Technology-driven EIC mediates the relationship between GOC and FP.

H_{6b} : Technology-driven EIC mediates the relationship between GOC and NFP.

4. Theoretical Framework

Figure 1 presents the hypothesised direct paths from GOC to business-driven and technology-driven EIC and from each EIC dimension to financial and non-financial performance, together with the four indirect mediation paths. For mediation testing, direct paths from GOC to financial performance and non-financial performance were also estimated in the structural model, although they are omitted from the figure to preserve visual clarity.

Figure 1: Theoretical Framework



5. Methodology

5.1 *Design*

This study employs a quantitative research design using a structured survey to investigate the relationship between green organisational culture (GOC), eco-innovative capability (EIC), and business performance (BP) among Malaysian firms across manufacturing and service sectors with environmental and sustainability relevance. The unit of analysis is the firm, while data were collected from top- and middle-level managers serving as key informants because of their knowledge of organisational culture, innovation activities, and firm performance.

All items in the questionnaire were measured using a 7-point Likert scale, allowing respondents to indicate the extent of their agreement or assessment with a range from 1 (strongly disagree) to 7 (strongly agree). Given the theory-driven and hypothesis-testing nature of this study, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed as the primary analytical technique. PLS-SEM was considered more appropriate than covariance-based SEM (CB-SEM) because the study involved a relatively small sample size, a mediation model with multiple latent constructs, and a primary objective of explaining and predicting relationships among constructs rather than confirming an established theory. It also imposes less restrictive distributional assumptions (Hair et al., 2022).

5.2 *Sampling and Data Collection*

Data were collected using an online questionnaire developed through Google Forms. The target population comprises Malaysian firms operating in manufacturing and service sectors that had implemented or were actively involved in environmental and sustainability-related practices, including green operations, environmental programs, eco-efficient technologies, and sustainability-oriented products and services.

The sampling frame comprised 165 firms registered with the Sustainable Energy Development Authority Malaysia (SEDA Malaysia). A survey invitation was sent to one eligible top- or middle-level manager in each firm. A total of 58 usable questionnaires were received, with each questionnaire representing a different firm. This resulted in a usable response rate of 35.2%. The remaining 107 invited firms did not provide a usable response.

A non-probability purposive sampling approach was

employed because participation was restricted to firms engaged in environmental and sustainability-related practices and to managers who met the key-informant criteria. Top- and middle-level managers were selected because of their knowledge of firm-level environmental strategies, capability development, innovation activities, and business performance.

A sensitivity analysis for the most complex endogenous construct, based on three predictors, a significance level of 0.05, and statistical power of 0.80, indicated that the sample was capable of detecting effect sizes of approximately $f^2 = 0.20$ or greater. Consequently, smaller effects may not have been detected, and the findings should be interpreted with appropriate caution. The cross-sectional data capture organisational practices and performance at a single point in time.

To reduce the potential for common method bias, several procedural remedies were implemented. These included assuring respondents of anonymity, minimising evaluation apprehension, and carefully designing the questionnaire to reduce item ambiguity and conceptual overlap (Lee and Sargeant, 2011; Larson, 2019).

5.3 Measures

The measurement instruments used in this study were adapted from validated scales in previous literature. Green organisational culture (GOC) was measured using nine items adapted from Aggarwal and Agarwala (2021), representing the dimensions of performance belief, alternative business philosophies, and industry macro-culture. These dimensions capture managerial beliefs and organisational values regarding environmental sustainability and are closely aligned with the conceptualisation of GOC adopted in this study. The use of nine items is consistent with the initial measurement model reported in the Results section.

Eco-innovative capability was measured using items adapted from Powell and Dent-Micallef (1997). Although the original instrument examined firm-level resources associated with technology-enabled competitive advantage, the items were contextually adapted to refer explicitly to environmental programmes, green planning, employee environmental training, green technology adoption, and environmental benchmarking. The adapted items therefore assess a firm's coordinated capability to mobilise managerial, organisational, and technological resources for eco-innovation rather than its general technological readiness (Sharma et al., 2021; Al-Hakimi et al., 2022; Cheng et al., 2014). The indicators were assigned a priori to

business-driven EIC, representing managerial and market-oriented deployment, and technology-driven EIC, representing technological and process-oriented deployment.

Financial performance was measured using profitability and return on investment. Non-financial performance was measured using competitive advantage and company image. All constructs were modelled reflectively in accordance with the latent-variable approach adopted in this study.

6. Results

6.1 Sample Profile

This study obtained 58 usable firm-level responses, representing a usable response rate of 35.2%. Given the modest and purposively selected sample, the findings are interpreted as evidence from sustainability-oriented firms operating in the sampled manufacturing and service sectors rather than as estimates that are automatically generalisable to all Malaysian firms.

As summarised in Table 1, the sample includes firms established across different decades, with the majority incorporated between 1990 and 2009. In terms of industry classification, nearly half (46.6%) operate in the services sector, followed by industrial (39.7%) and consumer goods manufacturing (13.8%). Most firms (98.3%) independently determine their short- and long-term goals. Sales performance varies, with around 30% reporting annual sales above RM 20 million, and 75.9% having international affiliations. Ownership is primarily public-listed (55.1%) or family-owned (39.7%). Domestic market sales dominate for 58.6% of the firms, while 29.3% derive more than half their sales from foreign markets. Respondents are evenly distributed between top- and middle-level management, with a majority (58.6%) having served in their roles for 5 to 10 years. The inclusion of experienced top- and middle-level managers across manufacturing and service firms provides contextually relevant perspectives for the study.

Table 1: Firm and Respondent Characteristics

Demographic	No	Percentage
<i>Year of Incorporation</i>		
• Before 1970	1	1.72%
• 1970 – 1979	4	6.90%
• 1980 – 1989	1	1.72%
• 1990 – 1999	24	41.40%
• 2000 – 2009	18	31.06%
• 2010 - present	10	17%
<i>Industry Classification</i>		
• Manufacturing (Consumer Goods)	8	13.8%
• Manufacturing (Industrial Goods)	23	39.7%
• Services	27	46.6%
<i>Does Your Company Determine Its Own Short-And Long-Term Goals?</i>		
• Yes	57	98.3%
• No	1	1.7%
<i>Average Total Sales in Three Years</i>		
• Less than RM 1 million	13	22.4%
• 1 - 4.9 million	13	22.4%
• 5 - 9.9 million	9	15.5%
• 10 - 20 million	9	15.5%
• 20 - 50 million	4	6.9%
• More than 50 million	10	17.2%
<i>International Affiliation</i>		
• Yes	44	75.9%
• No	14	24.1%
<i>Ownership Structure</i>		
• Family owned	23	39.7%
• Foreign owned	3	5.2%
• Publicly listed	32	55.1%
<i>Sales Allocation: Domestic Market</i>		
• Less than 50%	34	58.6%
• Greater than 50%	24	41.4%
<i>Sales Allocation: Foreign Market</i>		
• Less than 50%	41	70.7%
• Greater than 50%	17	29.3%
<i>Job Level</i>		
• Top Level	30	51.7%
• Middle Level	28	48.3%
<i>Year (s) of Service</i>		
• Less than 5	8	13.8%
• 5 – 10	34	58.6%
• 11 and above	16	27.6%

6.2 *Measurement Model*

As shown in Table 2, both Cronbach's alpha (CA) and composite reliability (CR) were used to evaluate the internal consistency of the constructs. The CA values range from 0.684 to 0.890. While most constructs exceeded the conventional 0.70 benchmark, GOC showed a marginally lower alpha of 0.684: its CR of 0.825 nevertheless indicated acceptable composite reliability.

The measurement model was assessed following a systematic item purification process. Initially, 22 indicators were specified, comprising 9 items for Green Organisational Culture (GOC), 4 items for business-driven (BD), 5 items for technology-driven (TD), and 2 items each for financial performance (FP) and non-financial performance (NFP) based on the measurement instruments described in the methodology. Subsequently, items with low factor loadings were removed based on established PLS-SEM guidelines. A loading threshold of 0.50 was adopted as the minimum acceptable level for indicator retention (Hair et al., 2022). Specifically, for GOC, six indicators (GOC1, GOC2, GOC4, GOC5, GOC6, and GOC7) were removed because their factor loadings fell below the recommended threshold. The retained indicators (GOC3, GOC8, and GOC9) demonstrated satisfactory loadings and collectively represented the dimensions of performance belief and industry macro-culture, which reflect managerial commitment to environmental performance and the broader environmental values embedded within the industry context. For TD, 4 out of the initial 5 items were retained, with TD3 removed due to insufficient loading. Overall, seven items were eliminated, resulting in a final measurement model consisting of 15 indicators. The retained GOC indicators achieved acceptable reliability and convergent validity (CA = 0.684, CR = 0.825, AVE = 0.611), indicating that they capture key aspects of Green Organisational Culture relevant to the context of this study. However, because only three of the original nine indicators were retained, the reduced measure provides a narrower representation of the construct and should be interpreted accordingly. Consequently, the alternative business philosophies dimension is not represented in the final retained measure, which further narrows the construct's content coverage and warrants caution when interpreting findings involving GOC.

Table 2 also presents the factor loadings. The remaining 15 items demonstrated satisfactory loadings, ranging from 0.696 to 0.954. To evaluate convergent validity, this study examined the average variance extracted (AVE) for each construct. As shown in Table 2, all

AVE values exceed the recommended minimum of 0.50, indicating that a substantial amount of variance is captured by the constructs relative to measurement error. Taken together, these results provide evidence of acceptable reliability and convergent validity for the retained indicators. Nevertheless, the substantial reduction in GOC indicators narrows the construct's content coverage and should be considered when interpreting the findings.

Table 2: Convergent validity

Constructs	Items	loadings	CA	CR	AVE
Green Organisational Culture (GOC)	GOC3	0.767	0.684	0.825	0.611
	GOC8	0.798			
	GOC9	0.779			
Eco-innovative capability:					
• Business-driven (BD)	BD1	0.748	0.729	0.829	0.549
	BD2	0.729			
	BD3	0.748			
• Technology-driven (TD)	BD4	0.738	0.776	0.856	0.599
	TD1	0.740			
	TD2	0.846			
	TD4	0.696			
	TD5	0.806			
Business Performance:					
• Financial	PROF	0.947	0.888	0.947	0.899
	ROI	0.950			
• Non-financial	ADV	0.944	0.890	0.948	0.900
	REP	0.954			

Notes: PROF = Profitability; ROI = Return on Investment; ADV = Competitive Advantage; REP = Corporate Reputation

This study assesses discriminant validity using two widely cited approaches in prior research: the Fornell–Larcker Criterion and the Heterotrait–Monotrait Ratio (HTMT). According to the Fornell–Larcker Criterion, discriminant validity is established when the square root of the Average Variance Extracted (AVE) for each construct is greater than the correlations between that construct and all other constructs (Hair et al., 2022). The results, as presented in Table 3, confirm that all constructs meet this criterion. In addition, the HTMT ratio was employed to further validate discriminant validity. As suggested by Henseler et al. (2015), HTMT values below 0.90 indicate adequate discriminant validity between constructs. The HTMT values in Table 4 demonstrate that all construct pairs satisfy

this threshold, further confirming the robustness of the measurement model. Overall, the combined evidence from reliability, convergent validity, and discriminant validity assessments indicates that the measurement model is statistically sound and suitable for subsequent structural model analysis.

Table 3: Discriminant validity (Fornell-Larcker Criterion)

	BD	FP	GOC	NFP	TD
BD	0.741				
FP	0.462	0.948			
GOC	0.681	0.418	0.781		
NFP	0.627	0.795	0.436	0.949	
TD	0.627	0.581	0.658	0.576	0.774

Notes: GOC = Green Organisational Culture; BD = Eco-Innovative Capability (Business-Driven); TD = Eco-Innovative Capability (Technology-Driven); FP = Financial Performance; NFP = Non-Financial Performance

Table 4: Discriminant validity (Heterotrait-Monotrait HTMT)

	BD	FP	GOC	NFP	TD
BD					
FP	0.552				
GOC	0.862	0.527			
NFP	0.757	0.894	0.551		
TD	0.836	0.701	0.883	0.687	

Notes: GOC = Green Organisational Culture; BD = Eco-Innovative Capability (Business-Driven); TD = Eco-Innovative Capability (Technology-Driven); FP = Financial Performance; NFP = Non-Financial Performance

6.3 Structural Model Test

To ensure the robustness of the structural model and address potential bias in the estimation, we first assessed collinearity using the full collinearity test (Kock, 2015). This approach is particularly useful for identifying common method bias in variance-based SEM. The results showed that all variance inflation factor (VIF) values ranged from 1.000 to 3.300, well below the conservative threshold of 3.30. Therefore, multicollinearity and common method bias are unlikely to pose significant concerns in this study.

Following this preliminary check, Table 5 presents the results of the structural model test, evaluating both direct and indirect

relationships between green organisational culture (GOC), eco-innovative capability business-driven (EIC-BD) and technology-driven (EIC-TD), and business performance (financial and non-financial). As indicated by the R^2 values, GOC explains 37.1% of the variance in EIC-BD and 42.3% in EIC-TD. Furthermore, GOC, EIC-BD, and EIC-TD collectively explain 32.9% of the variance in financial performance and 42.8% of the variance in non-financial performance. According to established PLS-SEM guidelines, these values indicate weak-to-moderate explanatory power, suggesting that the model explains a meaningful proportion of variance in the endogenous constructs (Hair et al., 2022). All Q^2 values are above zero (EIC-BD = 0.124, EIC-TD = 0.208, financial = 0.281, non-financial = 0.386), indicating acceptable predictive relevance of the model (Mateus et al., 2023). Statistical significance was assessed using two-tailed bootstrapping tests, with the corresponding t-statistics and p-values reported in Table 5.

Hypotheses H_1 and H_2 examine the effect of GOC on both eco-innovation dimensions. Results show significant and positive relationships for both paths (H_1 : $\beta = 0.618$, $t = 3.912$, $p < 0.001$; H_2 : $\beta = 0.658$, $t = 5.860$, $p < 0.001$), confirming GOC as a strong predictor of EIC. The effect sizes (f^2) for these relationships are substantial (H_1 : $f^2 = 0.619$; H_2 : $f^2 = 0.764$), indicating meaningful contributions to the explained variance. H_{3a} and H_{4a} evaluate the impact of EIC-BD on financial and non-financial performance. The findings indicate that EIC-BD does not significantly influence financial performance (H_{3a} : $\beta = 0.161$, $t = 1.003$, $p = 0.310$), but has a positive and significant effect on non-financial performance (H_{4a} : $\beta = 0.439$, $t = 3.240$, $p < 0.001$). This finding suggests that business-driven eco-innovation may not immediately translate into financial gains, as its effectiveness depends on market acceptance, customer demand, and stakeholder support for environmentally responsible products and practices. However, it appears to improve non-financial outcomes such as reputation and competitive positioning. The corresponding effect sizes suggest a negligible effect on financial performance ($f^2 = 0.024$) and a moderate effect on non-financial performance ($f^2 = 0.212$). In contrast, H_{5a} and H_{6a} test the influence of EIC-TD on financial and non-financial performance. Both relationships are positive and statistically significant (H_{5a} : $\beta = 0.480$, $t = 3.651$, $p < 0.001$; H_{6a} : $\beta = 0.301$, $t = 2.614$, $p = 0.009$), with effect sizes indicating moderate ($f^2 = 0.216$) and small ($f^2 = 0.099$) effects, respectively. These findings support the positive role of technology-driven eco-innovative capability in improving both financial and non-financial performance.

The mediation hypotheses (H_{3b} – H_{6b}) further examine the indirect effects of GOC on performance via EIC dimensions. Results show that EIC-BD does not mediate the relationship between GOC and financial performance (H_{3b} : $\beta = 0.099$, $t = 1.007$, $p = 0.316$) but significantly mediates the relationship with non-financial performance (H_{4b} : $\beta = 0.271$, $t = 2.470$, $p = 0.014$). Conversely, EIC-TD significantly mediates the effect of GOC on both financial performance (H_{5b} : $\beta = 0.316$, $t = 2.804$, $p = 0.005$) and non-financial performance (H_{6b} : $\beta = 0.198$, $t = 2.386$, $p = 0.017$). Importantly, the direct effects of GOC on financial performance ($\beta = 0.006$, $p = 0.972$) and non-financial performance ($\beta = -0.066$, $p = 0.654$) are not significant. The mediation results indicate that technology-driven EIC significantly mediates the effects of GOC on both financial and non-financial performance, whereas business-driven EIC mediates only the relationship between GOC and non-financial performance. No significant mediation effect was observed for the GOC $\rightarrow$ business-driven EIC $\rightarrow$ financial performance pathway.

Table 5: Summary of Hypotheses Testing

Hypotheses	f^2	β -values	T-stats	P-values	Results
H_1 Green Organisational Culture $\rightarrow$ Eco-Innovative Capability (Business-Driven)	0.619	0.618	3.912	<0.001	Supported
H_2 Green Organisational Culture $\rightarrow$ Eco-Innovative Capability (Technology-Driven)	0.764	0.658	5.860	<0.001	Supported
• Green Organisational Culture $\rightarrow$ Financial Performance	0.000	0.006	0.036	0.972	Not Supported
• Green Organisational Culture $\rightarrow$ Non-Financial Performance	0.004	-0.066	0.448	0.654	Not Supported
H_{3a} Eco-Innovative Capability (Business-Driven) $\rightarrow$ Financial Performance	0.024	0.161	1.003	0.310	Not Supported
H_{4a} Eco-Innovative Capability (Business-Driven) $\rightarrow$ Non-Financial Performance	0.212	0.439	3.240	<0.001	Supported
H_{5a} Eco-Innovative Capability (Technology-Driven) $\rightarrow$ Financial Performance	0.216	0.480	3.651	<0.001	Supported

Hypotheses	f^2	β -values	T-stats	P-values	Results
H_{6a} Eco-Innovative Capability (Technology-Driven) → Non-Financial Performance	0.099	0.301	2.614	0.009	Supported
H_{3b} Green Organisational Culture → Eco-Innovative Capability (Business-Driven) → Financial Performance	-	0.099	1.007	0.316	Not Supported
H_{4b} Green Organisational Culture → Eco-Innovative Capability (Business-Driven) → Non-Financial Performance	-	0.271	2.470	0.014	Supported
H_{5b} Green Organisational Culture → Eco-Innovative Capability (Technology-Driven) → Financial Performance	-	0.316	2.804	0.005	Supported
H_{6b} Green Organisational Culture → Eco-Innovative Capability (Technology-Driven) → Non-Financial Performance	-	0.198	2.386	0.017	Supported

7. Discussion

This study provides empirical evidence that EIC is the mechanism through which GOC becomes performance-relevant, but the mediation pattern differs by capability and outcome. Technology-driven EIC transmits the influence of GOC to both financial and non-financial performance, whereas business-driven EIC transmits it only to non-financial performance. This path-specific pattern clarifies how intangible cultural values are converted into different forms of organisational value (Subramanian & Suresh, 2023).

From an RBV perspective, the non-significant direct paths from GOC to both performance dimensions indicate that a green cultural resource does not automatically create measurable performance gains. The findings suggest that its performance relevance emerges through coordinated capabilities. Technology-driven EIC is the more consistent enabling capability because it is embedded in processes, equipment, and operational routines (Cheng et al., 2014; Kuo et al., 2022). Business-driven EIC also matters, but its mediating role is

confined to non-financial performance. The findings therefore support a differentiated, path-by-path interpretation rather than a general claim of full mediation.

The results further reveal a clear asymmetry between the roles of EIC-BD and EIC-TD. While GOC positively influences both forms of EIC, the two capabilities exhibit differentiated effects on performance outcomes. Specifically, H3a is not supported, indicating that EIC-BD does not significantly improve financial performance, although it significantly enhances non-financial performance. In contrast, EIC-TD exerts a significant positive effect on both financial and non-financial performance. This distinction is both theoretically and practically meaningful. EIC-TD reflects deeper, process-integrated innovations (such as cleaner production, eco-efficiency, and structural greening), which may be relatively more difficult to imitate because they are embedded in firm-specific processes and routines (Ch'ng et al., 2021; Kuo et al., 2022). In contrast, EIC-BD (e.g., eco-products and green marketing) may generate visibility and strengthen corporate reputation but may not immediately translate into financial returns. Within the Malaysian context, this finding may reflect the relatively limited monetisation of sustainability initiatives, where environmentally responsible products and marketing efforts do not always command a strong price premium or generate sufficient market demand to offset implementation costs. Furthermore, differences across manufacturing and service sectors may reduce the consistency of financial benefits derived from business-driven eco-innovation. Consequently, the benefits of EIC-BD appear to be more evident in reputational and market-based outcomes than in direct financial performance, consistent with prior arguments (Ben Amara & Chen, 2021; Kuo et al., 2022).

The significant effect of business-driven EIC on non-financial performance is consistent with research suggesting that eco-marketing, green product development, and customer-facing innovation strengthen corporate reputation, customer satisfaction, and competitive positioning (Scarpellini et al., 2018; Ben Amara & Chen, 2021). Technology-driven EIC contributes more directly to efficiency gains and cost reduction, explaining its consistent effects across both financial and non-financial outcomes (Ben Amara & Chen, 2021; Larbi-Siaw et al., 2023).

The findings refine RBV in the sustainability context in two respects. First, they do not establish GOC as a necessary resource; rather, they show that GOC has performance potential that depends on how it is deployed. Second, they demonstrate capability

heterogeneity: resources routed through different capabilities generate different forms of value. Technology-driven EIC produces both financial and non-financial benefits, while business-driven EIC produces selective non-financial benefits. RBV explanations of sustainability performance should therefore consider not only whether a capability exists, but also the type of capability and the outcome it is positioned to influence.

Practically, the results send a clear message to firms seeking to enhance performance through sustainability. The findings suggest that cultivating green values alone may not translate directly into performance. Firms therefore need to embed these values in organisational processes, technological investments, and business practices that support eco-innovation. This involves upgrading eco-technology infrastructure, redesigning production systems, and training personnel in green process innovation. At the same time, firms should not disregard business-driven eco-innovation, as it plays a critical role in strengthening non-financial outcomes such as reputation, customer satisfaction, and competitive advantage. These findings suggest that firms should strategically align capability investments with desired performance outcomes, rather than assuming uniform benefits across capability types.

Moreover, the study offers a cautionary insight for sustainability managers and policymakers. The common assumption that “going green” improves business performance is overly simplistic. The findings suggest that performance benefits are more likely to emerge when green values are translated into internal capabilities aligned with strategic priorities. The non-significant direct effects of GOC on performance highlight the importance of assessing how effectively green values are operationalised through organisational capabilities. Additionally, the path-specific and differentiated indirect effects observed in this study suggest that firms should adopt a balanced approach, integrating both technology-driven and business-driven eco-innovation strategies depending on the targeted performance outcomes.

7.1 Theoretical Contributions

The findings of this study contribute to the literature on the relationship between green organisational culture (GOC), eco-innovative capability (EIC), and business performance (BP) in two ways. First, this study advances the environmental sustainability literature by demonstrating how GOC, as an intangible organisational resource, is operationalised through eco-innovative

capabilities. Drawing on the Resource-Based View (RBV), this study conceptualises GOC as a potentially rare and difficult-to-imitate resource (Aggarwal & Agarwala, 2021; Abbas & Khan, 2022). However, the findings indicate that GOC did not show a significant direct association with either performance dimension. Instead, its performance relevance appears to operate through eco-innovative capabilities that translate environmental values into organisational actions. In this respect, the study refines the RBV perspective by highlighting that sustainability-oriented cultural resources require complementary capabilities before they become performance-relevant. This supports the RBV perspective that resources must be embedded and transformed into specific capabilities to yield sustainable competitive advantage (Subramanian & Suresh, 2023; Fok et al., 2022).

Second, this study extends the eco-innovation literature by distinguishing between business-driven and technology-driven EIC. While both dimensions are influenced by GOC, their effects on performance differ significantly. Specifically, business-driven EIC enhances non-financial performance but has no significant effect on financial performance, whereas technology-driven EIC improves both financial and non-financial performance. These findings suggest that the value of organisational capabilities depends on their strategic function and ability to generate performance outcomes. Accordingly, this study extends RBV by demonstrating that capabilities originating from the same organisational resource do not necessarily create equal value. Technology-driven EIC, which focuses on process and operational improvements, may be relatively more difficult for competitors to imitate because it is embedded in firm-specific processes and routines, while generating broader performance benefits. In contrast, business-driven EIC, such as eco-products and green marketing initiatives, primarily strengthens reputational and market-related outcomes, particularly in contexts where consumer demand for green products is still developing (Ben Amara & Chen, 2021; Larbi-Siaw et al., 2023).

7.2 Managerial Implications

This study offers several managerial implications for firms seeking to strengthen their business performance through sustainability-oriented strategies. The results indicate that GOC alone does not directly enhance financial or non-financial performance; rather, its impact materialises when it is translated into eco-innovative capabilities, particularly technology-driven innovations.

First, managers should recognise that cultivating GOC provides an important foundation, but it does not guarantee superior performance. Shared environmental values must be embedded in organisational systems, investment decisions, and employee routines. Managers can do this by supporting energy-efficient methods, waste-reducing processes, eco-compliant services, green product development, and market-facing sustainability initiatives, while matching each investment to the performance outcome sought (Ben Amara & Chen, 2021; Kuo et al., 2022).

Second, the results support differentiated resource allocation. Business-driven EIC significantly strengthens non-financial performance but shows no significant financial effect; managers should therefore evaluate green products, marketing, and business-model initiatives using reputation, customer, and competitive-positioning indicators rather than assuming immediate profitability. Technology-driven EIC should receive strong attention where the objective is cost efficiency, profitability, and durable competitive advantage because process and technology investments are more tightly connected to operational performance.

Third, leadership commitment plays a critical role in diffusing GOC across organisational levels. Boards and top managers should appoint leaders who are knowledgeable about sustainability issues and capable of creating enabling environments for employee-driven eco-innovation. By doing so, firms not only strengthen their innovation capacity but also build a reputation for environmental responsibility that enhances stakeholder trust and legitimacy (Aggarwal & Agarwala, 2021; Abbas & Khan, 2022).

Finally, supportive external environments can accelerate capability development. Policymakers can facilitate knowledge transfer, provide incentives for green technology adoption, and encourage collaboration between public and private organisations. Such support can help Malaysian manufacturing and service firms scale technology-driven eco-innovation while also strengthening market-oriented initiatives that improve stakeholder trust and competitive positioning.

8. Conclusion

This study examined how GOC influences financial and non-financial performance through business-driven and technology-driven EIC. GOC positively supports the development of both capability types, but their performance effects differ. Business-driven EIC improves non-financial performance and mediates the GOC–non-financial

performance relationship, but it has no significant financial effect and does not mediate the GOC–financial performance relationship. Technology-driven EIC improves both performance dimensions and mediates both corresponding relationships. The results therefore show that GOC becomes performance-relevant through specific capability pathways rather than through a uniform direct effect.

The principal managerial conclusion is not that business-driven eco-innovation reduces profitability, but that no significant financial effect was found in this sample. Business-driven initiatives remain valuable for reputation, market positioning, and other non-financial outcomes. Technology-driven eco-innovation produces more consistent benefits across performance dimensions. Firms should therefore align business- and technology-driven capability investments with the particular outcomes they seek to achieve.

9. Limitations and Future Agenda

This study has several limitations. First, the cross-sectional design and self-reported managerial data restrict causal inference. Longitudinal or panel studies could examine how GOC, capability development, and performance change over time. Second, the sample is small ($n = 58$) and was selected purposively from 165 firms registered with the Sustainable Energy Development Authority Malaysia (SEDA Malaysia). The sensitivity calculation indicates adequate power only for effects of approximately $f^2 = 0.20$ or larger; small effects may have gone undetected. The sampling approach and sectoral composition therefore limit generalizability. Third, although survey invitations were sent to 165 eligible firms and 58 usable responses were obtained (35.2% response rate), the use of purposive sampling and voluntary participation may have introduced non-response bias. Future studies should adopt probability sampling techniques and broader sampling frames to enhance the generalisability of the findings. Fourth, one top- or middle-level manager represented each firm, so future research should use multiple respondents and objective performance data. Fifth, only three of the initial nine GOC indicators were retained. Although reliability and convergent validity were acceptable, the reduced measure narrows content coverage and should be validated in larger samples. Finally, predictive assessment was limited to Q^2 ; future research should apply PLSpredict and examine external eco-innovation inputs from suppliers, partners, and industry networks.

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