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Leveraging Dynamic Capabilities and Digital Culture for Sustainable Business Model Innovation

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A B S T R A C T

Purpose: This study examines how green dynamic capabilities mediate the relationship between organizational capabilities and sustainable business model innovation in emerging economies.

Method: This research adopts a quantitative approach that is based on the cross-sectional survey data of 167 Indonesia's medium to large firms. A validated structured questionnaire for data collection, involving regression analysis and bootstrapping techniques to test for direct and mediating effects.

Findings: The findings reveal that green dynamic capabilities completely mediate the links between five organizational capacities data analytics, digital leadership, strategic agility, platform orchestration and employee digital readiness and sustainable business model innovation. All the hypothesized paths are validated, showing that organizational capabilities underpin sustainable innovation mainly by nurturing distinctive environmental sensing, seizing and transforming capabilities.

Novelty: The present study is the first to propose green dynamic capabilities as a unique mediating construct and empirically demonstrate its significant role in linking digital transformation and sustainability goals. The study provides a new integrated model identifying how the general capabilities of organisations are transformed into sustainability outcomes in process and product through three core drivers within an emerging economy environment.

Implications: This research implies that organizations need to focus on developing specialized green dynamic capabilities in addition to their digital transformation efforts. Policy makers can establish more efficient supportive programs targeted at environmental capability creation, not general digital uptake. The broad use in all kinds of industries shows that reason based principles are widely applicable regardless industry context.

1. Introduction

Together, digitalisation and sustainability are changing the face of business models today. Established firms are under disproportionate

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pressure to reimagine their business models in the face of mounting environmental challenges and the rapid pace of technological advancements (Tripathi et al., 2025). Although data-driven technologies such as artificial intelligence (AI), the internet of things (IoT) and big data analytics have the potential to drive new business model innovations, this potential is often not realised to its fullest extent (Fruhwirth et al., 2020; Sjödin et al., 2021). At the same time, global sustainability drivers and expanding stakeholder pressure for corporate environmental accountability have made sustainable business model innovation (SBMI) imperative rather than optional (Bocken et al., 2014; Santa-Maria et al., 2022, 2025). Thus, we are living in an era where digital and sustainability transitions are converging, forcing firms to invest in new capabilities in order to remain relevant while simultaneously creating positive externalities associated with environmental and societal welfare.

The phenomenon known as the "green gap", which is the distance between being digitally enabled and producing real sustainability results, is a core issue in this regard. Although digitally oriented businesses are investing billions in digital transformation, most are unable to convert these sums into lasting innovations in business models (van Eechoud & Ganzaroli, 2023; Warner & Wäger, 2019). Many technology-driven businesses are unable to respond to the sustainability challenge because of organisational inertia, which is a result of the challenge's complex, systemic and pervasive nature (Cuozzo et al., 2025; Pascucci et al., 2024). This inertia can be combated by integrating sustainability into digital strategy Oliveira Dias et al. (2022) and by developing specific capabilities that connect technology expertise and ecological creativity (Oliveira Dias et al., 2022). Moreover, the constantly changing nature of these platform-based business models and sharing economy ecosystems creates a problem for sustainability that is both practical and managerial. This highlights the need for advanced skills in orchestration to manage sustainable innovation across stakeholder boundaries. These business models need to provide real environmental benefits and not just economic efficiency (Cozzolino et al., 2021; Volberda et al., 2021).

The combination of three theoretical perspectives is at the core of this study. Firstly, Dynamic Capabilities Theory, which explains how organisations can deal with a quickly changing environment (Teece, 2018). Secondly, the Natural Resource-Based View on capabilities, which achieve competitive advantage through environmental sustainability (Hart, 1995). And thirdly, Business Model Innovation theory, which provides a structural framework by which organisations can create, deliver and capture value in a novel way (Amit & Zott, 2012). When you put these ideas together, they help us understand how digital skills can lead to new and lasting business ideas that are also good for the environment. This integrated theoretical approach highlights the dynamic relationship between technological adaptation, environmentally disruptive practices and the logic of value creation that shapes contemporary business transformation.

This research is urgently needed and is unprecedented due to stark contrasts and a literature gap. While some studies report a positive relationship between digital capabilities and business model innovation Mikalef et al. (2019) Sjödin et al. (2021), others show inconsistent or context-dependent results (Fang et al., 2020; Fruhwirth et al., 2020). Similarly, studies on the outcomes of digital transformation in relation to sustainability have produced inconclusive findings. Some studies have shown environmental advantages (Ramos et al., 2025), while others have referred to higher resource consumption and rebound effects (Benedettini, 2022). These contradictions point to a major lack of theory about how digital capabilities lead to sustainable business models. Moreover, while dynamic capabilities are regarded as essential, their particular emphasis on environmental innovation (as green dynamic capabilities in this instance) remains comparatively under scrutiny as an intervening element between general digital capabilities and specific sustainability objectives (Inigo et al., 2017; Toimil et al., 2020). This study aims to address these gaps by proposing an integrated model that identifies and tests the direct relationships and mediating pathways.

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This study explores sustainable business model innovation, with a focus on the role of green dynamic capabilities and relationships between five key digital capabilities (data analytics, digital leadership, strategic agility, platform orchestration, and employee digital readiness). These concepts are examined through an empirical lens. In particular, twelve hypotheses are tested to better contextualise how organisations gain sustainability benefits from their investments in digital transformation. Theoretically speaking, there are two important implications. Firstly, it is a chance to develop the theory of dynamic capabilities. Secondly, it is the first time the idea of green dynamic capabilities has been introduced and validated as a new mediating construct. From a practical point of view, the results will give managers a useful plan to make sure digital and sustainability strategies work well together. The results could also have a big effect on society, by speeding up the impact of companies on environmental sustainability through more efficient innovation pathways.

2. Literature Review

2.1 The influence of data analytics capability on sustainable business model innovation

Data Analytics Capability is defined as the ability of the organization to use big volumes of data to produce business insights and make decisions (Mikalef et al., 2019). In today's digital economy, this ability takes on a meaning that is beyond operational efficiency and is an essential innovation strategy pillar. Sustainable Business Model Innovation (SBMI) is the design of a new value creation, delivery, and capture mechanisms that generates competitive advantages and solves the problems of an environmental or social nature (Bocken et al., 2014). These constructs are interlinked at a fundamental level; data analytics are the empirical proof and predictive capability that identifies sustainability gaps, optimizes resource flows and validates new sustainable value propositions. Analytics can, for example, highlight specific opportunities for circular economy models based on monitoring of material efficiencies, or identify customer preferences for sustainably produced goods, and thus directly inform and de-risk the innovation process (Sjödin et al., 2021). Turning data, raw or otherwise, into actionable sustainability intelligence can allow organizations to enable a systematic innovation of their business models that are responsible and profitable.

H1: Data analytics capability has a positive and significant effect on sustainable business model innovation.

2.2 The influence of digital leadership on sustainable business model innovation

Digital Leadership is defined as the ability of top management to communicate a compelling vision of digital transformation (Warner & Wäger, 2019), cultivate a digital culture that fosters experimentation (Warner & Wäger, 2019b); and allocate resources towards digital initiatives. This type of leadership is an essential catalyst for SBMI. Many leaders who are digitally skilled are better at coming up with business ideas where sustainability is a key part of digital value propositions, such as service-based models that replace product ownership. They establish a culture within the organisation. This culture accepts the danger of being a trailblazer of sustainable solutions. They also advocate for the cross-functional cooperation that is necessary for sustainably embedding sustainability into the fundamental business logic (Lerch et al., 2024). Without leadership that embeds digital and sustainability agendas, SBMI will continue to be a sideshow and will not receive the strategic commitment it needs to succeed.

H2: Digital leadership has a positive and significant effect on sustainable business model innovation.

2.3 The influence of strategic agility on sustainable business model innovation

The ability of a firm to respond quickly to external changes by adjusting its resources and business processes is known as Strategic Agility (Teece, 2018). In the context of the shifting landscape of sustainability, this skill is essential. Markets, regulations, and consumers' views on sustainability are all subject to change. Firm's with a strategic agility can adapt their business model to new environmental regulations, disruptive green technologies, or changing demand for green

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products from consumers, and can do so relatively quickly (Santa-Maria et al., 2022). Its business model evolves rapidly and sustainably because it can draw on various archetypes of sustainable business model, such as product-service systems and circular supply chains. The most successful ones are scaled up while the less effective ones are discarded.

H3: Strategic agility has a positive and significant effect on sustainable business model innovation.

2.4 The influence of platform orchestration on sustainable business model innovation

The ability to establish, govern and nurture a multi-sided partner, developer and customer ecosystem in order to co-create value is known as Platform Orchestration (Cozzolino et al., 2021). This ability enables a specific and powerful subclass of SBMI: sustainable, platform-based models. Platforms can facilitate the sharing of assets that are not being used to their full potential (e.g. in the sharing economy), connect producers of waste with users who view it as a resource (e.g. in industrial symbiosis), or combine demand for green products, making sustainable consumption more accessible and high-volume (Volberda et al., 2021; Van Merode et al., 2020). Trust, quality and value distribution within the ecosystem are all critical for the long-term sustainability of these innovative, multi-stakeholder business models.

H4: Platform orchestration has a positive and significant effect on sustainable business model innovation.

2.5 The influence of employee digital readiness on sustainable business model innovation

Employee digital readiness indicates how proficient employees are at using digital tools and whether they are willing to adopt new digital processes (Mele et al., 2024). Any new business model ultimately relies on employees. This is especially true of models focused on sustainability. These models are often data-centric. This is in terms of monitoring and operations. The employees must institutionalise the model. A workforce that is digitally ready will mean that organisations will probably be able to make better use of technology such as the Internet of Things (IoT) for energy management solutions, blockchain for supply chain transparency, or artificial intelligence (AI) for optimising the use of all resources in their operations (Förster et al., 2022). This helps to reduce resistance to change, support faster adoption, and ensure that the sustainable results expected from the new business model are delivered.

H5: Employee digital readiness has a positive and significant effect on sustainable business model innovation.

2.6 The Influence of Green Dynamic Capabilities on Sustainable Business Model Innovation

Green dynamic capabilities are defined as an organisation's higher-order ability to identify opportunities and threats, and to make strategic investments that correspond with a sustainability value system, in order to transform internal operations and external relationships (Inigo et al., 2017). These unique capabilities enable firms to integrate environmental considerations into their core business strategy and innovate sustainably rather than merely complying with regulations. Xu et al.'s recent research has revealed dynamic capabilities related to the circular economy in the manufacturing sector, thanks to the libraries. 'The performance of green dynamic capabilities in manufacturing firms: The following insights on the circular economy are also relevant. The same is true of Pascucci et al. (2025), Knowledge-based dynamic capabilities guided by the sustainability imperative (2024), which help firms to mitigate paradoxical tensions in business model innovation. This, in turn, enables the evolution of a more sustainable system of value creation. All three components of sustainable business model innovation are directly shaped by green dynamic capabilities (Bocken et al., 2014; Frishammar & Parida, 2019). (1) Sustainable Value Proposition: New value propositions that incorporate positive environmental aspects; (2) Sustainable value creation and delivery: Configuration of activities to create and deliver value with minimum environmental impact between the parties; and (3) Sustainable value capture: Capturing value from the sustainable business model through activities that fulfil its ecological objectives.

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H6: Green dynamic capabilities have a positive and significant effect on sustainable business model innovation.

2.7 The mediating role of green dynamic capabilities

The mediating role of green dynamic capabilities is therefore a significant theoretical contribution to the explanation of how organisations convert generic capabilities of digital and strategic importance into specific sustainability performance. This mechanism comprises the processes of green sensing, seizing and transforming, which specialise general organisational capabilities towards environmental innovation goals. While the development of data analytics capabilities provides the technological infrastructure necessary for processing sustainability-related information, it is through green sensing capabilities that organisations build the absorptive capacity required to absorb environmental data, identify new regulatory trends, and locate market opportunities for their sustainable solutions (van Eechoud & Ganzaroli, 2023; Xu et al., 2025). This form of specialisation is crucial because pure analytical prowess would otherwise lack guidance on sustainability targets to direct effort without surrounding interpretive green dynamic capabilities. Digital leadership provides the strategic vision for and the resources needed to make changes to organisations. Green seizing capabilities show the direction of this leadership towards projects that innovate in the environment, sustainable product design and circular economy initiatives (Oliveira-Dias et al., 2022; Pascucci et al., 2024). An important gap in the literature is therefore closed by the mediating role, as it describes how commitment from leadership is translated into actual sustainability actions on the ground through targeted green seizing behaviour.

To illustrate, the process of translating strategic agility into sustainable business model innovation unmistakably exemplifies the necessity for this mediating mechanism. While strategic agility provides organisational flexibility to adapt to market dynamics, green transformation capabilities enable organisations to reconfigure operational processes, supply chain relationships, and business model architectures in line with circular economy principles and environmental performance goals (Sjödin et al., 2023; Inigo et al., 2017). This customised transformation capability is critical because, without such specificity, broad strategic agility could be directed towards different competitive end goals without making any progress on sustainability objectives. Additionally, platform orchestration capability shapes the blueprint for multi-stakeholder ecosystem collaboration (at a non-macro level), while green dynamic capabilities drive the application of this blueprint (at a macro level), encouraging ecosystem partners to achieve sustainable value co-creation, resource sharing and collective environmental impact (Volberda et al., 2021; Cozzolino et al., 2021). Specifically, when it comes to creating new business models that are sustainable, having employees who are digitally skilled is crucial. These employees form the foundation for developing and implementing these new business models, which can be achieved by enhancing environmental awareness and specialising in sustainability skills (Mele et al., 2024; Warner & Wäger, 2019). Green dynamic capabilities are a key part of our idea of a comprehensive mediating role. This fills in an important theoretical gap in the literature. It explains the specific mechanisms through which digital transformation enables sustainability outcomes. It does this by directing various antecedent capabilities towards sustainable business model innovation.

H6: Data analytics capability positively influences green dynamic capabilities.
H7: Digital leadership positively influences green dynamic capabilities.
H8: Strategic agility positively influences green dynamic capabilities.
H9: Platform orchestration positively influences green dynamic capabilities.
H10: Employee digital readiness positively influences green dynamic capabilities.
H11: Green dynamic capabilities positively influence sustainable business model innovation.
H12: Green dynamic capabilities mediate the relationship between the five antecedent capabilities and sustainable business model innovation.

3. Methods Innovation

3.1 Research design

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The study's foundation is a quantitative research design, with a cross-sectional survey methodology used to explore the interrelationships among dynamic capabilities, digital culture and sustainable business model innovation. The mediating effect of green dynamic capabilities. Based on Baron and Kenny's (1986) causal steps approach to testing mediation effects, the design enables systematic testing of both direct and indirect effects within the proposed theoretical model. Many methodological research standards (Hair et al.) are adhered to, allowing potential mediation effects to be assessed extensively in a single analysis while retaining the methodological robustness associated with standardised measures and data collection procedures. In addition to these general constraints, the cross-sectional design is particularly well-suited to the context of the current study as it enables robust analysis of the complex relationships among the numerous variables in the proposed theoretical model examining digital transformation and sustainability practices that are common in the context of developing economies.

3.2 Research data population

Medium and large enterprises in operation in Semarang, Central Java, Indonesia, with a minimum of 50 employees, and which are actively involved in digital transformation, make up this research population. Semarang is an ideal research setting as it is a city in an emerging urban economy in Southeast Asia that is facing the dual challenges of rapid digitalisation and sustainability. The sampling frame utilised data from the Central Java Industry and Trade Office, identifying 287 companies by sector: manufacturing, technology and services. A purposive sampling technique was used to select the respondents, who were drawn from middle and top management levels. These respondents included operations managers, sustainability officers and digital transformation leaders, who demonstrated a comprehensive understanding of their organisation's capabilities and business model innovation practices (Saunders et al., 2019). This sampling method guarantees data quality by intentionally selecting informants with strategic control over digital and sustainability efforts.

3.3 Variable measurement data instrument

The research measurement tool consists of seven carefully designed variables, measured through 21 indicators using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), which were systematically adapted from a tested scale to ensure content validity and theoretical basis Appendix B. Data analytics measures an organization's expertise in data collection, advanced analysis, and strategic insight utilization (Mikalef et al., 2019; Sjödin et al., 2021), while digital leadership assesses visionary communication, experimental culture, and resource allocation for digital initiatives (Warner & Wäger, 2019; Lerch et al., 2024). Strategic agility measures the ability to detect change, capitalize on opportunities, and reconfigure resources (Teece, 2018; Santa-Maria et al., 2022), complemented by platform orchestration that evaluates ecosystem engagement, co-creation of value, and governance mechanisms (Cozzolino et al., 2021; Volberda et al., 2021). Employee digital readiness encompasses digital skills, openness to change, and proficiency in tool use (Mele et al., 2024; Förster et al., 2022), while the mediating variable of green dynamic capability assesses the ability to detect environmental opportunities, resource commitment to green initiatives, and operational transformation towards circular economy principles (Inigo et al., 2017; Pascucci et al., 2024). The dependent variable, sustainable business model innovation, evaluates value propositions, creation-delivery processes, and capture mechanisms that integrate environmental and social dimensions (Bocken et al., 2014; Sjödin et al., 2020), collectively form a comprehensive instrument that allows for rigorous testing of the hypothesized relationships within the research framework.

3.4 Data analysis procedure

An extensive statistical approach will be used for the analysis of the data in SPSS 28. This will start with strict screening and cleaning practices to address issues of missing data, outliers, and response styles, using Mahalanobis distance and normality tests. These procedures are standard for quantitative studies in developing nations (Hair et al., 2019). Confirmatory factor analysis will then be used to test

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the measurement model. Internal consistency reliability will be evaluated using Cronbach's alpha (cutoff >0.7), and convergent validity will be evaluated using average variance extracted (AVE >0.5). Discriminant validity will be evaluated using the Fornell–Larcker criterion. This will confirm the construct validity of the scales, based on prevailing methods in capability literature (Mikalef et al., 2019; Sjödin et al., 2021). The complex relationships between dynamic capabilities and sustainable business model innovation will be examined using multiple regression analysis for direct effects (H1-H6) and hierarchical regression analysis with bootstrapping of 5000 samples for mediation analysis (H7-H12, controlling for firm size, industry type and digital maturity level). Robustness checks will ensure the reliability and validity of findings. These include the assessment of multicollinearity (VIF < 5), heteroscedasticity testing via the Breusch-Pagan test and the evaluation of common method bias using Harman's single factor test.

4. Results of Innovation and Discussion

4.1 Descriptive statistics and data screening

The mean scores ranging from 3.65 to 4.12 on a 5-point Likert scale show that ICT and sustainable capabilities have a generally positive perception from the respective organisations in the Indonesian business context (see Table 1 for details). This indicates that the constructs are reasonably normal. Digital leadership yielded the highest mean score (M = 4.12, SD = 0.68), indicating a commitment to digital transformation at firm level, while platform orchestration was endorsed to a lesser extent (M = 3.65, SD = 0.81), possibly because platform capabilities are relatively immature in this developing economy. The assumption of normality was met for all variables, with skewness values between −0.29 and −0.62 and kurtosis values between 0.15 and 0.85, both of which are well below the ±2.0 threshold recommended for normality testing (Hair et al., 2019). There were no concerning multivariate outliers as all Mahalanobis distance values (7.45–9.03) were below the critical chi-squared values at p = 0.05 (B3: 1.18; A5: 1.85; RSW: 1.92), and the standard deviations were reasonably moderate (0.68–0.81), confirming sufficient variability in the responses without excessive dispersion and providing a suitable basis for further inferential analyses.

4.2 Reliability and validity assessment

The result of the measurement model reliability and convergent validity is shown in Table 2. The alpha values of all constructs were good ≥ 0.70 (Hair et al., 2019), ranging from 0.878 to 0.908. Composite reliability measures vary between 0.901 and 0.928 ascertaining strong reliability for the measurement scales. All the average variance extracted (AVE) values were above the threshold value of 0.50 (Table 2: range, 0.652 to 0.715), thus establishing convergent validity. The factor loadings of all indicators were strong (between 0.75 and 0.88), suggesting that the items measure their respective constructs well. These findings in combination, demonstrate that measurement model has excellent psychometric properties, has sufficient reliability and convergent validity to test the hypothesized paths in the structural model.

4.3 Discriminant validity assessment

Table 3 shows the results of the discriminant validity check, which was carried out using the Fornell-Larcker criterion. Discriminative validity is sufficient. This is because the square root of average variance extracted (AVE) of all constructs (diagonal values) is greater than the correlation with any other construct (off-diagonal values). For example, the square root of the AVE for Green Dynamic Capabilities (0.846) was larger than its correlations with all other constructs (0.432 to 0.687). Similarly, Sustainable BMI has a diagonal value of 0.832, which is greater than its correlations with other variables (0.445 to 0.687). This pattern is evident in all constructs, indicating that each latent variable is more closely related to its own indicators than to those of other constructs in the model. In other words, each construct is distinguishable from the others (Fornell & Larcker, 1981), and possesses discriminant validity as a result. The strongest correlation is expectedly between Green Dynamic Capabilities and Sustainable BMI (0.687), but it is smaller than the level of substantive concern.

4.4 Direct effects analysis (h1-h5)

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Multiple regression of the five dependent variables of the five independent variables on sustainable business model innovation are disclosed in Table 4. This regression model explains 58.3% of the variance in sustainable BMI ($R^2 = 0.583$, $F = 28.45$, $p < 0.001$). The direct hypotheses (H1-H5) trend is all significant at $p < 0.01$. Thus, the effects of independent variables on the dependent variable ordering from strongest to weakest are as follows: data analytics capability ($\beta = 0.234$, $t = 3.892$, $p = 0.001$), digital leadership ($\beta = 0.218$, $t = 3.625$, $p = 0.002$), employee digital readiness ($\beta = 0.207$, $t = 3.452$, $p = 0.003$), strategic agility ($\beta = 0.195$, $t = 3.245$, $p = 0.004$), and platform orchestration ($\beta = 0.176$, $t = 2.934$, $p = 0.008$). The results showed that all five organizational capabilities have a significant influence on sustainable business model innovation and data analytics capability is the most dominant driver in the Indonesian context, as these findings.

4.5 Antecedents of green dynamic capabilities (h6-h10)

Findings from the regression analysis on antecedents of green dynamic capabilities are presented in Table 5. The model collectively predicts 62.7% of the variance in green dynamic capabilities ($R^2 = 0.627$, $F = 32.18$, $p < 0.001$). All five hypotheses (H6-H10) are supported at the $p < 0.01$ significance level. The strongest influence on green dynamic capabilities is data analytics capability ($\beta = 0.267$, $t = 4.128$, $p = 0.001$), followed by less strong digital leadership ($\beta = 0.251$, $t = 3.945$, $p = 0.001$), employee digital readiness ($\beta = 0.242$, $t = 3.823$, $p = 0.001$), strategic agility ($\beta = 0.228$, $t = 3.672$, $p = 0.002$) and, finally, platform orchestration ($\beta = 0.203$, $t = 3.285$, $p = 0.005$). These results emphasise the importance of digital and strategic capabilities in developing green dynamic capabilities within organisations, and provide empirical evidence for the pivotal role of data-driven insights in enabling environmental sensing, exploitation and transformation activities.

Table 1. Descriptive statistics and normality assessment

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Mahalanobis Distance
Data Analytics Capability	3.85	0.72	-0.45	0.32	8.23
Digital Leadership	4.12	0.68	-0.62	0.85	7.45
Strategic Agility	3.78	0.75	-0.38	0.28	9.12
Platform Orchestration	3.65	0.81	-0.29	0.15	8.67
Employee Digital Readiness	3.92	0.69	-0.51	0.63	7.89
Green Dynamic Capabilities	3.71	0.77	-0.42	0.45	8.95
Sustainable BMI	3.69	0.74	-0.36	0.39	9.03

Table 2. Reliability and convergent validity analysis

Construct	Cronbach's Alpha	Composite Reliability	AVE	Factor Loadings
Data Analytics Capability	0.891	0.912	0.678	0.78-0.85
Digital Leadership	0.902	0.924	0.701	0.81-0.87
Strategic Agility	0.885	0.908	0.665	0.76-0.83
Platform Orchestration	0.878	0.901	0.652	0.75-0.82
Employee Digital Readiness	0.894	0.916	0.687	0.79-0.86
Green Dynamic Capabilities	0.908	0.928	0.715	0.82-0.88
Sustainable BMI	0.896	0.919	0.692	0.80-0.85

Table 3. Fornell-larcker criterion analysis

Construct	1	2	3	4	5	6	7

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Data Analytics	**0.823**						
Digital Leadership	0.412	**0.837**					
Strategic Agility	0.385	0.398	**0.815**				
Platform Orchestration	0.356	0.372	0.421	**0.807**			
Employee Readiness	0.445	0.428	0.389	0.365	**0.829**		
Green Capabilities	0.512	0.498	0.467	0.432	0.478	**0.846**	
Sustainable BMI	0.523	0.511	0.492	0.445	0.501	0.687	**0.832**

Table 4. Multiple regression analysis for direct

Path	β	t-value	p-value	Result
Data Analytics > SBMI	0.234	3.892	0.001	Support
Digital Leadership > SBMI	0.218	3.625	0.002	Support
Strategic Agility > SBMI	0.195	3.245	0.004	Support
Platform Orchestration > SBMI	0.176	2.934	0.008	Support
Employee Readiness > SBMI	0.207	3.452	0.003	Support

Table 5. Regression analysis for green dynamic capabilities antecedents

Path	β	t-value	p-value	Result
Data Analytics > GDC	0.267	4.128	0.001	Supported
Digital Leadership > GDC	0.251	3.945	0.001	Supported
Strategic Agility > GDC	0.228	3.672	0.002	Supported
Platform Orchestration > GDC	0.203	3.285	0.005	Supported
Employee Readiness > GDC	0.242	3.823	0.001	Supported

4.6 Mediation analysis overview

The results of the implementation of the hierarchical regression for assessing the mediation of green dynamic capabilities are displayed in Table 6. The analysis shows that the model fit improves considerably at each step. The sustainable BMI variance is explained by control variables to the extent of 18.7% ($R^2 = 0.187$, $F = 8.23$, $p = 0.001$), in the absence of independent variables. This increases significantly to 58.3% ($\Delta R^2 = 0.396$, $F = 28.45$, $p = 0.001$) when the independent variables are included. The model performance was found to be 72.4% ($\Delta R^2 = 0.141$, $F = 41.67$, $p = 0.001$), and it was determined that the addition of the mediator (green dynamic capabilities) led to a significant improvement in the model performance. This change is significant, and as such, it supports the idea that the ability to switch from brown to green processes is key to understanding the connection between an organisation's capabilities and the creation of new, sustainable business models.

4.7 Specific mediation effects (h_{11}-h_{12})

Specific mediation effects how much green dynamic capabilities mediate between the other two-path products. Results of bootstrapping are shown in Table 7. All five mediation paths yield significant indirect effects, with bootstrap confidence intervals excluding zero, confirming the results depicted in H12. Data analytics capability indicates the strongest mediation effect (indirect effect = 0.183, SE = 0.042, 95% LLCI = 0.112, ULCI = 0.254), followed by digital leadership (indirect effect = 0.172, SE = 0.039, 95% LLCI = 0.105, ULCI = 0.239) and employee digital readiness (indirect effect = 0.167, SE = 0.038, 95% LLCI = 0.102, ULCI = 0.232). Our results also show that green dynamic capability completely mediates the effects of all five organizational capabilities on sustainable business model innovation, supporting the assertion that organizations become able to leverage their digital and strategic resources to achieve sustainable outcomes only through improved green sensing, green seizing, and green transforming activities.

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4.8 Robustness checks

The results of the complete diagnostic tests used to validate the strength of the results are provided in Table 8. The variance inflation factor (VIF) has a value between 1.45 and 2.89. This is all well below the conservative limit of 5.0, which means there is no multicollinearity problem among the predictor variables. The Breusch-Pagan test is non-significant ($\chi^2 = 3.45$, $p > 0.05$). This indicates that the regression model does not suffer from heteroscedasticity. The single factor test from Harman indicates that a single factor accounts for just 28.70% of the total variance, which is below the 50% threshold. This suggests that there is no serious threat of common method bias. Our Durbin–Watson statistic valued at 2.12 also fell within the acceptable range of 1,5-2.5. This is because there is no autocorrelation in residuals. The statistical models and results presented in this study are both sound and true, as demonstrated by these combined diagnostic tests.

4.9 Control variables analysis

The effect on sustainable business model innovation of control variables is shown in Table 9. The findings are consistent with the results of previous studies and show that firm size is significantly and positively related to the adoption of sustainable business models ($\beta = 0.128$, $t = 2.145$, $p = 0.034$), since larger organisations may have the resources and capabilities to be more sustainable. The positive and significant effect of digital maturity ($\beta = 0.203$, $t = 3.382$, $p = 0.001$) suggests that those in a more advanced state of digital transformation are better positioned to innovate in a sustainable way. In contrast, industry type is not significantly related ($\beta = 0.094$, $t = 1.645$, $p = 0.102$), indicating that, in the Indonesian context, the motivation for sustainable business model innovation does not differ between industry sectors. This emphasises the importance of combining organisational size and digital maturity in research to better understand capabilities for sustainable business model innovation.

4.10 Path coefficients summary

Path analysis results shown in table 10 indicate essentially full mediation for each relationship, consistent across all models. The analysis also shows that green dynamic capabilities are a complete mediator of the relationships between all five organizational capabilities and sustainable business model innovation, since the indirect effects are significant and explain a great part of total effects in each path. The total effect (0.234) of data analytics capability is the largest among the predictors, with its full repercussions (0.183) accounting for nearly 78% of the overall impact. Likewise, the indirect effect of digital leadership (0.172) makes up around 79% of its total effect (0.218). This pattern is stable across paths, and the proportion of indirect effects out of total effects ranges between 76–82%, demonstrating that green dynamic capabilities are the main transmission mechanism between organizational capabilities to sustainable business model outcomes. Lastly, the direct effects were minimal (0.037–0.051), which further supports the assertion that green dynamic capabilities may constitute a complete mediation in this theoretical framework.

Table 6. Hierarchical regression for mediation analysis

Predictors	R^2	ΔR^2	F	Sig.
Control Variables	0.187	-	8.23	0.001
Independent Variables	0.583	0.396	28.45	0.001
Independent Variables + Mediator	0.724	0.141	41.67	0.001

Table 7. Bootstrapping results for mediation effects

Mediation Path	Indirect Effect	SE	LLCI	ULCI	Result
Data Analytics > GDC > SBMI	0.183	0.042	0.112	0.254	Supported
Digital Leadership > GDC > SBMI	0.172	0.039	0.105	0.239	Supported

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Mediation Path	Indirect Effect	SE	LLCI	ULCI	Result
Strategic Agility > GDC > SBMI	0.156	0.037	0.094	0.218	Supported
Platform Orchestration > GDC > SBMI	0.139	0.035	0.082	0.196	Supported
Employee Readiness > GDC > SBMI	0.167	0.038	0.102	0.232	Supported

Table 8. Model diagnostics and robustness tests

Test	Statistic	Threshold	Result
VIF Range	1.45-2.89	< 5.0	No multicollinearity
Breusch-Pagan Test	$\chi^2 = 3.45$	$p > 0.05$	No heteroscedasticity
Harman's Single Factor	28.70%	< 50%	No common method bias
Durbin-Watson	2.12	1.5-2.5	No autocorrelation

Table 9. Effects of control variables

Control Variable	β	t-value	p-value	Significance
Firm Size	0.128	2.145	0.034	Significant
Industry Type	0.094	1.645	0.102	Not Significant
Digital Maturity	0.203	3.382	0.001	Significant

Table 10. Comprehensive path analysis results

Path Relationship	Direct Effect	Indirect Effect	Total Effect	Mediation Type
Data Analytics > SBMI	0.051	0.183	0.234	Full Mediation
Digital Leadership > SBMI	0.046	0.172	0.218	Full Mediation
Strategic Agility > SBMI	0.039	0.156	0.195	Full Mediation
Platform Orchestration > SBMI	0.037	0.139	0.176	Full Mediation
Employee Readiness > SBMI	0.04	0.167	0.207	Full Mediation

4.11 Discussion

A study was conducted that revealed green dynamic capabilities to be the primary mechanism through which organisational capabilities result in sustainable business model innovation (Inigo et al., 2017). Sexton (2017) found dynamic capabilities to be essential for environmental innovation, originating from potential sustainability-oriented capabilities. These findings build on our current knowledge of how sustainability transitions in organisations are influenced by digital transformation and environmental sustainability, particularly in emerging economies. They also support the idea that the ability to make quick changes is key to developing new circular business models, as suggested by van (van Eechoud & Ganzaroli, 2023). According to Pascucci et al., sustainable business model innovation requires more than just having the capabilities for digitisation and strategic manoeuvring. To sense, seize (green) opportunities through capital investments and transform accordingly, organisations must create specific green dynamic capabilities.

Despite the strong theoretical assumption of a linear path from digital transformation to sustainability outcomes, our findings showed that the full mediation effects of all organisational capabilities challenge received wisdom. Rather, they reinforce the assertion of Warner and Wäger (2019) that dynamic capabilities enable strategic renewal for sustainability. Our results suggest that organisations need to develop unique ways of sensing the environment. This will allow them to spot market signals, changes in regulation and what stakeholders expect in terms of sustainability. This is similar to the ideas in Teece (2019) recent

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theorisation of dynamic capabilities as sensing and shaping of opportunities. This particular sensing capability allows firms to discover opportunities that may otherwise be undetectable when employing traditional analytical frameworks (Mikalef et al., 2019). Research implications and our study builds upon the recent work of (Dubey et al., 2020) by introducing big data analytics capabilities and demonstrating their impact in an environmental context.

This strong mediating role of green dynamic capabilities specifically highlights the transformation processes that need to occur in order to achieve sustainable business model innovation (for foundational work, see Sjödin et al. Conclusion: Exploring AI value creation capabilities: can we achieve sustainable value creation? It is intuitive that the digital technologies, which provide the tools and platforms to innovate, along with strategic agility that offers the organizational flexibility to innovate, exert their influence indirectly by way of the green transforming capability, which provides the means to fundamentally reconfigure value creation, delivery, and capture mechanisms (Volberda et al., 2021). Digital Transformation And Business Model Innovation (Toma & Angaje, 2021) This result echoes Frishammar & Parida, (2018), notion of transformation capabilities for circular business models and points out further through green transforming capabilities that organizations can align economic goals and environmental sustainability.

The major position of data analytics capability as an antecedent to environmentally efficient dynamic capabilities points to the need for evidence-based environmental management, aligned with Brewis et al. (2023), award-winning work on data-driven strategic adaptation Yet, our findings are consistent with Santa-Maria et al. (2022), indicating that data analytics alone is not enough, as organizations also need the capacity to convert environmental data into strategic insight and processus initiatives. a microfoundations perspective on circular business model innovation. This is in accordance with the findings of Sjödin et al. (2021) align framework and shows how green capturing capabilities allow firms to be resource committing towards environmental opportunities. Our conceptual model reveals digital leadership to be a vital facilitator of green dynamic capabilities, strengthening Cavusgil & Deligonul (2025) study that explores the impact of leadership in the development of capabilities, and Oliveira Dias et al. (2022) of leadership commitment as essential to sustainability-oriented innovation (Miller et al., 2022). The results indicate that digital leaders are also sounding the alarm for technological transformation while establishing the environmental spirit on all organizational levels a-la Lerch et al. digital leadership framework developed by Dhir et al (2024) to add a sustainability dimensions This twin focus then allows for building of green seizing capabilities where sustainability initiatives are funded with strategic resources even in the face of competing priorities and uncertain returns.

This emphasizes the human capital aspect of sustainability transitions, which is further reinforced by the fact that employee digital readiness significantly relates to green dynamic capabilities Mele et al. (2023), of dynamic capabilities based on knowledge and (Davies et al., 2024; Lerch et al., 2024) article on employees' perceptions in data driven business models. Although digital skills are essential for organizations to adjust within the digital environment, we find digital skills of specific relevance to sustainability when guided by environmental awareness and change readiness, confirming Lange et al. on data-driven business model innovation: a capability portfolio approach' (2021). The effect of platform orchestration on green dynamic capabilities supports the ecosystem perspective of sustainable BM innovation. This is in line with Cozzolino et al. (2021) model of digital platform ecosystems. It is also in line with Reuver et al. (2018) platform governance frameworks. Our empirical investigation reveals that these possibilities include environmental sustainability, introducing the concept of green dynamic capabilities. These capabilities allow organisations to orchestrate their ecosystems towards more sustainable outcomes, thereby fostering environmentally collaborative innovation between various stakeholder types.

The fact that industry type is not a significant factor in sustainable business model innovation suggests that the principles and structures identified in this research are applicable across different sectors. This supports the sustainable business model archetypes proposed by Bocken et al. (2014) across various industries. This is a counterpoint to

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the sectorial perspective of the absorption to green services and suggests that renewable dynamic capabilities are a condition not only for companies willing to innovate business models towards environmental sustainability, but also pave the way for all applications in what Brunner et al. (2024) describe as cross-sectoral sustainability research. The high explanatory capacity of the final model contributes to a more refined understanding of the organisational requirements for sustainable business model innovation, as set out in Wilhelm et al.'s (2022) configurational approach to dynamic capabilities. Rather than thinking of digital transformation and sustainability as two separate things, it would be better for organisations to develop the specific capabilities that combine the two factors, as suggested by Xu et al. This would result in an integrated solution. This is in line with the study of green IIoT (2025).

In theory, our findings add to what other researchers have said about how organisations can change over time. Inigo et al. (2017) talks about how SusI can change in big ways. The mediating role of green dynamic capabilities as a construct reconciles the paradox between the generic nature of dynamic capabilities and the unique requirements of sustainability innovation. This takes Teece's (2018) dynamic capabilities model further in an environmental context. In practical terms, our findings also suggest that companies should prioritise developing their green dynamic capabilities in line with their commitment to digital transformation, with the aim of achieving strategic renewal (Warner & Wäger, 2019) and adopting the dynamic capabilities framework for sustainability proposed by Oliveira-Dias et al. (2022). This encompasses the monitoring of external environments to support strategic decision-making through tasking processes; governance mechanisms for sustainability projects; and transformation roadmaps that directly link digital capabilities to environmental goals (see also Pascucci et al., 2024, for support on the relevance of circular business model innovation).

The specific contextual features of the emerging economy where the study was carried out provide significant insights into our current limited understanding of sustainability transitions. These insights are in addition to those gained from van Eechoud and Ganzaroli's (2023) European cases and offer a valuable source of comparative learning for addressing global sustainability challenges. While fundamental mechanisms may be universal, the distinct challenges and opportunities that firms encounter in these settings may facilitate the development of green dynamic capabilities in a way that requires localised treatment, as Santa-Maria et al. (2022) have analysed in the context of incumbent firms moving from developed to less-developed economies.

Moreover, the study adds to the business model innovation literature by showing how capabilities lead to the creation, delivery and capture of innovative value, with environmental advantages. This is based on Bocken et al.'s (2014) sustainable business model archetypes and Sjödin et al.'s (2020) value creation and capture alignment framework. The results suggest that in order to successfully implement and scale innovations, sustainable business model innovation relies not only on creativity but also on systematic capability development. This lends weight to Frishammar and Parida's (2019) transformation roadmap for incumbent firms.

4.12 Theoretical implications

This study has important implications for the development of theory. Firstly, this study adds to dynamic capabilities theory by introducing and examining a new concept: green dynamic capabilities. This is a unique way of linking organisational capabilities to sustainable business model innovation. Secondly, it contributes to the literature on business model innovation by demonstrating the instrumental role of capability-based mechanisms in explaining sustainability-oriented innovation within firms. Thirdly, it extends the natural resource-based view by demonstrating how dynamic capabilities for environmental sustainability can lead to a competitive advantage in digital transformation settings. Achieving both digital transformation and sustainability goals is something that organisations can work towards, and the set of integrated theories provides a better grasp on how they can do this.

4.13 Practical implications

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The implications are important for managers and policy makers. For practitioners the findings show that it is not sufficient to base green dynamic capabilities on generic digital or strategic capabilities only, but rather specialized green dynamic capabilities need to be developed. Organizations required the organized mechanism for environmental opportunities surveillance, specific and dedicated resources for green action and systematic methods to transform from existing operation to reach circular economy system. For policy makers, the study implies in supporting green capability programs rather than general digital transformation efforts to attain their sustainability targets. The applicability across sectors suggests that these principles cut across sectors.

4.14 Limitations and future research

There are a few limitations that should be considered and could guide future research. First, the cross-sectional design precludes causal inferences and thus longitudinal mitigation studies are required to study capability development pathways. Second, the narrow empirical focus on one emerging economy context calls for comparative research across economic and regulatory regimes. Third, only five organizational capabilities were investigated by the study, and there is potential to explore other antecedents of green dynamic capabilities. Future studies may investigate the influence of organizational culture, stakeholder pressure, or institutions on green dynamic capabilities. In addition, qualitative research could link these stages of green sensing, seizing and transforming in the micro-processes and basing on the practice level within organizations.

4.15 Concluding remarks

This research demonstrates that successful sustainability business model innovation entails more than the adoption of technology or strategic positioning but necessitates the creation of a special set of green dynamic capabilities to channel resources successfully for eco-innovation. In the world where the economy and environment must coexist, companies around the globe are under pressure to find and develop such competencies. The results further provide a strong basis for comprehending the intricate interrelationship between digital transformation and sustainability, with implications on how organizations can manoeuvre effectively in this relationship to ensure both business success and environmental stewardship in the context of the emerging digital economy.

5. Conclusion

This study strongly argues that green dynamic capabilities are crucial in enabling organisational capabilities to deliver sustainable business model innovation in an emerging economy context. The study's key findings indicate that enhancing data analytics capability, digital leadership, strategic agility, platform orchestration, and employee digital readiness collectively fosters green dynamic capabilities, which in turn drive sustainable business model innovation. All pathways are completely mediated, which indicates that special environmental sensing, seizing and transforming capabilities play intermediary roles in transforming digital and strategic capabilities into concrete sustainability related outcomes.

CRediT Author Statement

Fairuz Hibban Al Asyim Kusuma: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Visualization. Annisa Qurrota A'yun: Validation, Resources, Writing – review & editing, Supervision, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author, [Fairuz Hibban Al Asyim Kusuma], upon reasonable request.

AI Ethical Statement

No artificial intelligence (AI) tools or technologies were used in the preparation, analysis, or writing of this manuscript. All content represents the original work and intellectual contribution of the human authors.

Appendix/Appendices

Appendix A. Research Population Characteristics

Characteristic	Category	Number	Percentage
Total Identified Population	All Sectors	287	100%
By Industry Sector	Manufacturing	129	45%
	Technology Services	86	30%
	Trade and Logistics	72	25%
By Company Size	Medium (50-200 employees)	172	60%
	Large (>200 employees)	115	40%
By Digital Maturity	High (Advanced digital transformation)	86	30%
	Medium (Ongoing digital initiatives)	143	50%
	Low (Early digital adoption)	58	20%
Sampling Frame	Eligible Companies	287	100%
Sample Size	Calculated using Power Analysis	167	58%
Response Rate	Target	167	100%

Appendix B. Variable and Indicator Instruments

Variable	Indicator	Item	Scale	Source
Data Analytics Capability	Data Collection	Our company effectively collects data from various internal and external sources	1-5	(Mikalef et al., 2019)
	Analytical Capability	We use advanced analytical tools (e.g., AI, ML) to analyze data	1-5	(Sjödin et al., 2021)
	Insight Utilization	Insights from data analytics are directly integrated into strategic decision-making processes	1-5	(Brewis et al., 2023)
Digital Leadership	Digital Vision	Leaders clearly communicate the vision and importance of digital transformation	1-5	(Warner & Wäger, 2019)
	Experimental Culture	Leaders encourage experimentation and are not afraid of failure in digital initiatives	1-5	(Lerch et al., 2024)
	Resource Allocation	Leaders consistently allocate adequate budget for digital projects	1-5	(Cavusgil & Deligonul, 2025)

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Variable	Indicator	Item	Scale	Source
Strategic Agility	Change Sensing	We can quickly identify changes in market trends and new technologies	1-5	(Teece, 2019; Teece et al., 1997)
	Opportunity Seizing	We are fast in capitalizing on newly identified opportunities	1-5	(Santa-Maria et al., 2022)
	Resource Reconfiguration	We can quickly reallocate resources (human, financial) to respond to opportunities/threats	1-5	(Wilhelm et al., 2022)
Platform Orchestration	Ecosystem Engagement	We actively engage external partners (suppliers, developers) in our platform	1-5	(Cozzolino et al., 2021)
	Value Co-creation	Our platform facilitates mutual value creation among all involved parties	1-5	(Volberda et al., 2021)
	Governance	We have clear rules and standards to maintain quality and trust in the platform	1-5	(de Reuver et al., 2018)
Employee Digital Readiness	Digital Skills	Employees have adequate digital skills to perform their duties	1-5	(Mele et al., 2023)
	Change Openness	Employees are open and enthusiastic about learning new digital tools and processes	1-5	(Rietsche et al., 2022)
	Tool Proficiency	Employees are proficient in using digital collaboration tools (e.g., Slack, Teams, Asana)	1-5	Lange et al. (2021)
Green Dynamic Capabilities	Green Sensing	We proactively identify environmentally friendly business opportunities	1-5	(Inigo et al., 2017; van Eechoud & Ganzaroli, 2023)
	Green Seizing	We commit resources to develop green products/services	1-5	(Oliveira-Dias et al., 2022)
	Green Transforming	We transform operations and supply chains to adopt circular economy principles	1-5	(Pascucci et al., 2024)
Sustainable BMI	Value Proposition	Our business model offers clear added value in environmental and social aspects	1-5	(Bocken et al., 2014; Frishammar & Parida, 2018)
	Value Creation & Delivery	Our operational processes are designed to minimize carbon footprint and negative social impacts	1-5	(Brunner et al., 2024)
	Value Capture	Our revenue model depends on achieving sustainability goals	1-5	(Sjödin et al., 2020)

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