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The twin transition under resource constraints: A proposed conceptual model for digital and green capability convergence

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Abstract: This study proposes an integrated framework to demystify the strategic mechanisms through which enterprises in transitional economies achieve digital and green capability convergence (the "Twin Transition") despite severe resource constraints. To achieve this, the conceptual paper develops a theoretical model grounded in Resource Orchestration Theory and the Theory of Bricolage, outlining a quantitative survey design targeting top management with data analysis proposed via Consistent Partial Least Squares Structural Equation Modeling (PLSc-SEM). Specifically, the model posits that Resource Orchestration Capability acts as a core mediating mechanism transforming Digital Technology and Green Innovation Capabilities into Strategic Agility and Competitive Advantage. Furthermore, Bricolage Capability is integrated as a vital moderating variable that empowers organizations to navigate financial deficits effectively. Ultimately, the paper concludes that resource scarcity is not an insurmountable barrier; rather, when orchestrated through a bricolage mindset, it paradoxically acts as a catalyst for breakthrough twin transition innovation. As a result, the framework offers actionable insights for SME executives in emerging markets, suggesting that leveraging low-cost assets through bricolage enables them to meet stringent global sustainability and digital standards without heavy capital investments.

Keywords: *Bricolage capability, Resource orchestration theory, Strategic agility, Twin transition, Vietnam.*

1. Introduction

Currently, the global business landscape has witnessed the profound shaping of two transformative macro forces: the impact of digital technology [1] and the urgent imperative for sustainable development [2], an intersection conceptualized as the "twin transition" [3]. In emerging economies like Vietnam, pressures from this twin transition place enterprises in a paradoxical dilemma: on one hand, they confront increasingly stringent environmental standards within global value chains, the imperative to digitalize operational processes whilst simultaneously complying with increasingly stringent ecological barriers imposed by developed nations, a prominent manifestation of this is the Carbon Border Adjustment Mechanism (CBAM) introduced by the European Union to levy carbon emissions tariffs on imported goods [4, 5], while simultaneously needing to digitalize to sustain competitiveness [1]; on the other hand, the prevailing economic structure, dominated by small and medium-sized enterprises (SMEs), forces them to operate under a severe scarcity of capital, high-quality human resources, and technological infrastructure [6, 7]. The tension between high-standard integration requirements and acute resource deficiencies yields a unique empirical context that demands the re-evaluation and contextual recalibration of strategic management frameworks.

Despite the growing attention directed toward digital and green transformations, extant literature still exhibits three major research gaps. *First*, the majority of traditional studies approach digital technology capability and green innovation capability as independent trajectories. While recent visionary scholars strongly advocate for their integration conceptualized as the Twin Transition [8, 9], quantitative research examining their convergence and synergistic effects on strategic outcomes

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remains exceedingly rare. *Second*, a "black box" phenomenon persists within contemporary research models; studies frequently posit a direct causal relationship between the mere possession of technology or green certifications and competitive advantage, thereby neglecting the limitations inherent in the traditional Resource-Based View (RBV) [10]. According to Resource Orchestration Theory (ROT), the mere possession of isolated resources does not automatically generate value; rather, value is created only when managers effectively structure, bundle, and leverage those resources [11, 12]. *Third*, prevailing theories on dynamic capabilities are predominantly constructed within the context of European corporations, where resource abundance is a default assumption. Consequently, this perspective fails to adequately explain how enterprises in emerging markets, such as Vietnam, innovate under severe financial constraints. The concept of "bricolage", defined as the ability to create value from resources at hand [13], has yet to be fully integrated into research models addressing the twin transition.

To address the aforementioned theoretical gaps, this study is conducted with three core objectives. *First*, it empirically examines the synergistic interaction effect between Digital Technology Capability and Green Innovation Capability [14, 15]. *Second*, it unravels the hidden strategic mechanism by analyzing the mediating role of Resource Orchestration Capability in translating isolated capabilities into Strategic Agility [16] and Sustainable Competitive Advantage. *Third*, it explores the model's boundary conditions by evaluating the moderating role of bricolage capability [17], thereby examining whether the flexible utilization of resources can amplify the effectiveness of the resource-orchestration process within the context of emerging markets.

This study makes three significant theoretical contributions. First, it enriches Resource Orchestration Theory [12] by extending its application to the era of the twin transition. The research demonstrates that for complex initiatives such as digitalization and greening, top management's resource orchestration capability acts as an indispensable transmission mechanism rather than a mere auxiliary factor. Second, it provides empirical evidence to bridge the fragmentation between two disparate academic domains: Information Systems (IS) and Environmental Management, asserting the necessity of investigating digital and green initiatives as co-evolving capabilities. Finally, by incorporating bricolage capability into the model, this research challenges the traditional assumption of reliance on resource abundance [18]. The proposed framework establishes a new paradigm: resource constraints are not necessarily barriers to innovation; rather, when governed by a bricolage mindset, they can serve as a catalyst propelling firms to successfully execute a digital-green convergence strategy.

2. Literature Review

2.1. Resource Orchestration Theory

The Resource-Based View (RBV) has long dominated strategic management research. According to the traditional RBV [19], a firm's competitive advantage stems from the possession of resources that are valuable, rare, inimitable, and non-substitutable. However, in highly dynamic business environments, scholars have identified a major "blind spot" within the RBV: the mere possession of resources does not automatically translate into competitive advantage [10]. A firm may possess state-of-the-art technology yet still fail if its top management cannot effectively operationalize and deploy it [9].

To address this gap, Resource Orchestration Theory (ROT) was developed by Sirmon, et al. [12], serving as an inevitable evolution of the RBV. Unlike the RBV, which focuses on the static nature of the asset portfolio, ROT emphasizes the dynamism of managerial actions. ROT posits that sustainable competitive advantage is generated through intentional managerial interventions aimed at structuring, bundling, and leveraging organizational resources [11].

Specifically, the resource orchestration process encompasses three critical stages [12]: (1) *structuring*, which shapes the resource portfolio through acquiring, accumulating, and divesting unsuitable resources; (2) *bundling*, which integrates fragmented resources into core capabilities, an action that involves stabilizing current processes, enriching existing capabilities, and pioneering new ones; and

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(3) *leveraging*, which commercializes the bundled capabilities to exploit market opportunities, encompassing the mobilizing, coordinating, and deploying of these capabilities within specific strategies to create customer value.

For the twin transition context in emerging markets such as Vietnam, ROT provides an optimal analytical framework. First, digital technologies and environmental standards are inherently fragmented and highly imitable resources (e.g., any firm can purchase ERP software or hire an ISO 14001 consultant). According to ROT, these assets in themselves do not generate a competitive advantage; rather, it is how top management "bundles" them into internal processes and "leverages" them to reconfigure business models that determines success. Second, given that small and medium-sized enterprises (SMEs) face severe resource constraints [6], the strategy of acquiring and possessing rare, premium, and inimitable resources as emphasized by the traditional RBV is often financially unfeasible. Instead, the capability to creatively orchestrate what is currently available emerges as a vital alternative mechanism for forging a competitive advantage.

2.2. The Digital-Green Convergence and the Mediating Role of Orchestration Capability

Digital capability is frequently defined as the organizational ability to sense, seize, and transform emerging technologies (e.g., AI, Big Data, IoT) to reconfigure business processes and customer experiences [1]. Meanwhile, green innovation capability encompasses efforts in green product design and green process optimization aimed at mitigating adverse ecological impacts [14].

However, the majority of current studies tend to approach these two capabilities as independent trajectories. The Information Systems (IS) stream of research typically views digital technology merely as a tool to optimize pure operational performance. Conversely, the environmental management literature often frames green initiatives as strategic responses to institutional pressures aimed at achieving legitimacy [2]. This fragmentation creates a significant "blind spot," ignoring the reality that, in the era of the Fourth Industrial Revolution, sustainable development goals cannot be attained without a digital data foundation. Inversely, recent literature highlights the "double-edged sword" nature of digitalization, warning that digital technologies without a sustainability orientation can lead to massive resource dissipation and negative environmental costs [9, 20].

The concept of the "twin transition" posits that digitalization and greening processes can co-evolve and mutually reinforce each other [3]. Digital technology acts as a core "catalyst" for green strategies; for instance, Internet of Things (IoT) systems and big data analytics enable enterprises to precisely quantify carbon emissions, track product lifecycles, and propel circular economy models. Conversely, environmental standards can endow digital investments with a clearer strategic direction. We argue that this green orientation acts as a safeguard against the "productivity paradox," a phenomenon identified in recent literature where firms invest massively in digital technologies without realizing commensurate value gains [21].

Despite its immense synergistic potential, the digital and green convergence does not unfold autonomously. The simultaneous imposition of novel technological systems and stringent environmental standards frequently triggers internal frictions, exhausts financial resources, and overburdens personnel. This operational friction constitutes the very "black box" that prior studies have failed to adequately resolve when postulating a direct causal link between the twin transition and competitive advantage.

Utilizing the lens of ROT, this study argues that resource orchestration capability acts as an indispensable mediating mechanism, specifically: *first*, to avert resource trade-offs, top management must undertake structuring actions to divest energy-intensive legacy technologies while acquiring novel data assets; *second*, through bundling actions, firms must interweave information technology systems into environmental control processes, for instance, leveraging ERP software to automate ESG reporting, thereby transforming two fragmented systems into a synchronized, highly inimitable capability; *finally*, through leveraging actions, this integrated configuration is commercialized into novel value propositions, such as providing customers with carbon-traceable products.

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It is precisely through these three continuous sequences of orchestration actions that the digital-green convergence is effectively transformed into strategic agility, defined as the organizational capacity to rapidly reconfigure in response to market dynamics and, ultimately, sustainable competitive advantage. In the absence of orchestration capability, the intersection of digital and green initiatives merely induces operational chaos rather than superior strategic outcomes.

2.3. Theoretical Foundations

To construct a research model that demystifies the "black box" of the twin transition in transition economies, this study is predicated upon two intertwined core theoretical premises:

First, drawing upon Resource Orchestration Theory (ROT) [12], the fundamental premise posits that higher-order capabilities, such as digital technology and green innovation, do not function autonomously; rather, their presence within an organization engenders both pressures and opportunities, thereby compelling top management to activate orchestration mechanisms, namely, structuring, bundling, and leveraging, to unlock and capture value.

Second, anchored in the Theory of Bricolage pioneered by Baker and Nelson [13], the subsequent premise posits that resource scarcity does not constitute a definitive barrier to strategic innovation endeavors. In environments where small and medium-sized enterprises (SMEs) suffer from severe deficits in financial and human capital, "bricolage," defined as the capability to engineer solutions utilizing resources at hand, regardless of their patched and imperfect nature, serves as a vital catalyst. This bricolage approach empowers enterprises to circumvent institutional and financial constraints, thereby facilitating the execution of complex strategies conventionally regarded as the exclusive domain of large, well-resourced corporations [17].

The translation of digital and green capabilities into strategic advantage adheres to a rigorous endogenous causal logic:

Upon investing in digital capabilities (e.g., data analytics platforms) or green capabilities (e.g., clean production processes), organizations confront a massive influx of novel knowledge and operational procedures. To avert fragmentation, these capabilities necessitate that top management execute decisive resource-restructuring actions. Furthermore, the convergence of digital and green initiatives engenders a potent synergistic effect. Digital data provides empirical substantiation and precise measurement capabilities for green objectives, whereas green standards orient digital technologies toward sustainable value creation, thereby precluding dispersed investments [9, 20]. This intricate interplay compels the organization's "bundling" mechanism to operate at its peak efficacy.

ROT posits that the mere existence of technology or environmental certifications does not automatically engender agility. Strategic agility, defined as the capability to rapidly detect and reallocate resources in response to market dynamics [16], manifests only when top management successfully "leverages" bundled capabilities [11, 12]. Consequently, resource orchestration capability acts as the vital "bridge," transforming static instruments into an agile organizational reflex.

Under ideal conditions, the digital and green convergence fuels the resource orchestration process. However, managerial logic suggests that within Vietnamese SMEs, tight budgetary constraints can disrupt this process. At this juncture, bricolage intervenes as a moderating variable. A firm endowed with high bricolage capability does not wait for expensive ERP software or million-dollar filtration systems. Drawing on the theoretical foundations of bricolage [13, 18], firms can navigate resource deficits by creatively recombining assets at hand. In the contemporary twin transition context, this mindset is manifested through practical actions such as deploying open-source software and recycling materials, while extending to modern applications like integrating free cloud platforms and cross-training personnel to maximize limited internal capacity. This capability facilitates a smoother, more cost-effective, and significantly accelerated resource orchestration process.

Empirical research has also provided substantial corroboration for the aforementioned logical continuum, although no prior study has integrated these constructs into a singular overarching framework:

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The study by Warner and Wäger [1] demonstrates that digitalization endeavors generate a strategic imperative that compels top management to continuously renew and reconfigure organizational resources (analogous to the concept of orchestration).

Regarding synergistic effects, Singh and El-Kassar [22] provide quantitative evidence from firms operating within both the Gulf Cooperation Council (GCC) and the Middle East and North Africa (MENA) regions (specifically the UAE, Saudi Arabia, Egypt, and Lebanon), demonstrating that integrating big data analytics with green organizational practices serves as a vital catalyst for superior green product and process innovation.

Concerning the mediating role, Carnes, et al. [11] empirically validated the ROT framework, asserting that orchestration actions undertaken by the Top Management Team (TMT) serve as a prerequisite for transforming asset portfolios into superior firm performance.

Finally, the seminal study by Senyard, et al. [17] on 300 SMEs provides empirical substantiation that bricolage functions as the core driver enabling resource-constrained enterprises to successfully launch breakthrough innovations.

2.4. Hypothesis Development and Research Model

Drawing upon the elucidated theoretical premises, logical reasoning, and empirical corroboration, this study formally postulates the following hypotheses:

Hypotheses 1 & 2 (Direct Effects): Digital technology capability and green innovation capability are inherently characterized by high complexity. The augmentation of these capabilities within an organization compels top management to continuously recalibrate, structure, and bundle the asset portfolio to optimize operational efficacy and avert resource dissipation.

H_1: Digital technology capability exerts a positive effect on resource orchestration capability.

H_2: Green innovation capability exerts a positive effect on resource orchestration capability.

Hypothesis 3 (Synergistic Effect): When enterprises concurrently pursue both digitalization and greening initiatives, their convergence engenders a transparent informational foundation (derived from digital technologies) to resolve ecological optimization imperatives (dictated by green objectives). This synergistic resonance cultivates a highly complex resource system, exerting positive pressure that demands intensified strategic orchestration and leveraging actions from top management.

H_3: The interaction between digital technology capability and green innovation capability exerts a positive synergistic effect on resource orchestration capability.

Hypothesis 4 (Mediation Effects): The Direct Impacts of Resource Orchestration Capability (ROC) on Strategic Agility (SA) and Sustainable Competitive Advantage (SCA).

Grounded in Resource Orchestration Theory (ROT) [12], the mere possession of isolated resources, such as digital technologies or green initiatives, is insufficient for an organization to automatically adapt to volatility or outpace competitors. True strategic value is catalyzed only when top management executes purposive managerial actions encompassing the structuring, bundling, and leveraging of these asset portfolios. Concerning the relationship with Strategic Agility (SA), ROC functions as the core operational mechanism. Strategic agility necessitates the firm's capacity to seamlessly reallocate capital, personnel, and technological flows in the face of market shocks [16]. When an enterprise possesses robust ROC, the structuring process enables the rapid identification and divestment of obsolete assets, whereas the bundling process facilitates the flexible amalgamation of digital infrastructure and green processes to forge novel dynamic capabilities. Consequently, continuous resource orchestration engenders fluidity and responsiveness within the organizational architecture, empowering the firm to scale operations up or down without encountering stagnation barriers. Based on this rationale, the following hypothesis is proposed

H_{4a}: Resource Orchestration Capability (ROC) has a positive impact on Strategic Agility (SA).

Regarding Sustainable Competitive Advantage (SCA), this relationship directly addresses the inherently "static" limitations of the traditional Resource Based View (RBV) [10]. A competitive advantage is deemed sustainable if and only if competitors face profound difficulties or exorbitant costs

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in attempting to imitate or substitute it [19]. ROC shifts the strategic paradigm from the "possession" of assets to their "deployment." By continually sculpting digital and green resources into complex internal ecosystems, the resource orchestration process constructs a formidable knowledge barrier. While competitors may readily acquire digital software or adopt commercially available emission-filtration technologies, they cannot replicate the intricate manner in which the enterprise orchestrates, operationalizes, and integrates these two capability streams into its organizational culture under managerial coordination. This causal ambiguity serves as the foundational source that sustains the longevity of competitive advantages in terms of cost, quality, and time to market. Therefore, the following hypothesis is proposed:

H_{4b}: Resource Orchestration Capability (ROC) has a positive impact on Sustainable Competitive Advantage (SCA).

Hypothesis 5 (Moderating Effect): In resource-constrained environments, the synergistic effect between digital and green initiatives may be stifled if the organization adheres to a conventional investment paradigm. Bricolage capability acts as a vital catalyst in this context. Firms exhibiting strong bricolage capability can execute the structuring and bundling of digital and green assets by creatively deploying overlooked resources, repurposed materials, or low-cost technologies. Consequently, bricolage mitigates financial inertia, amplifying the magnitude of the synergistic effect on the orchestration mechanism.

H_5: Bricolage capability positively moderates the relationship between the digital-green synergistic effect and resource orchestration capability.

(Specifically, the higher the bricolage capability, the stronger the synergistic impact of digital and green capabilities on resource orchestration.)

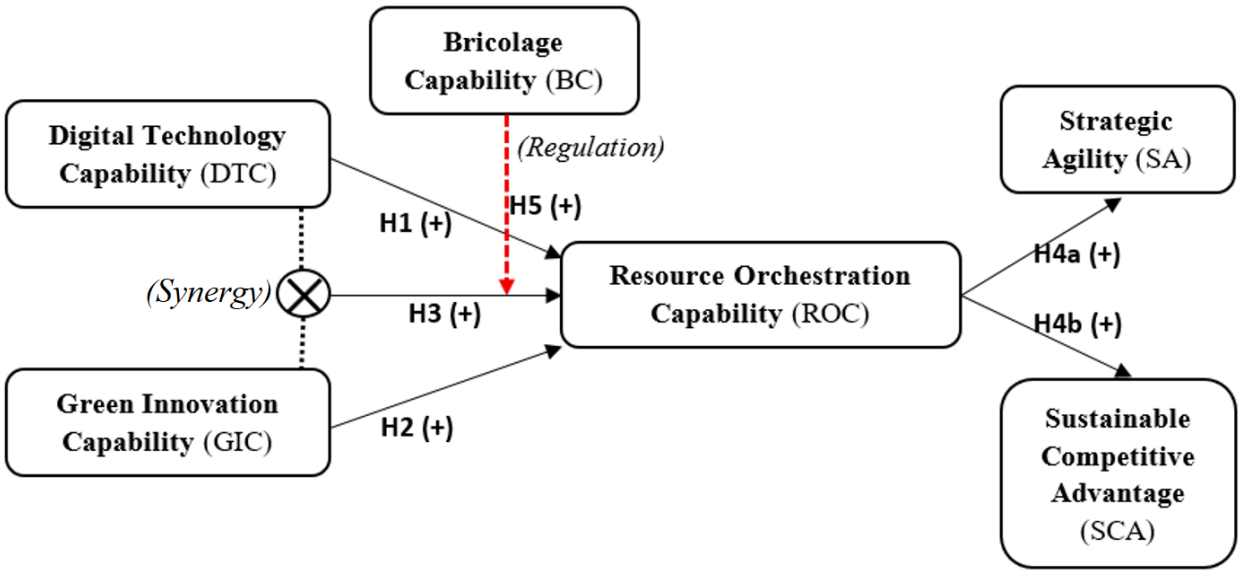

Figure 1.
Proposed research model.

3. Proposed Research Methodology

3.1. Measurement Scales

To ensure content validity and international comparability, this study adopts validated multiitem scales derived from prominent prior research. All latent variables were assessed using a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

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The proposed translation and scale adaptation process will strictly adhere to the five-step back-translation procedure originally outlined by Brislin [23] and Brislin [24] strongly recommended by recent methodological reviews such as Kowal [25]. *First*, the original English measurement items will be forward-translated into Vietnamese by the author. *Second*, they will be back-translated into English by two PhD-level English linguistics lecturers who will remain blind to the original scales. *Third*, the original and back-translated versions will be compared to sort out the reasons for any semantic discrepancies. *Fourth*, a pilot study will be conducted with a small group of target respondents to ensure comprehension and clarity, particularly to mitigate the academic abstraction of the "bricolage" construct. *Finally*, the ultimate version of the translated scales will be revised and finalized before the main survey distribution as presented in Table 1.

Digital Technology Capability (DTC): Measured using a four-item scale adapted from Khin [15], this construct focuses on the firm's capacity to deploy digital technologies to sense market opportunities and reconfigure business processes.

Green Innovation Capability (GIC): Operationalized through a four-item scale adapted from Chen, et al. [14]. While the original instrument was formulated to assess green innovation performance, the item wordings have been deliberately modified in this study to capture the firm's underlying capability and proactive intent to execute such innovations. This variable assesses eco-innovation capabilities across both green product and green process dimensions aimed at mitigating pollution.

Resource Orchestration Capability (ROC): Assessed via a six-item multidimensional construct developed specifically for this study. Taking conceptual inspiration from the qualitative strategic behaviors identified by Carnes, et al. [11] and grounded in the theoretical framework of Sirmon, et al. [12], these self-developed items reflect three strategic actions: structuring, bundling, and leveraging digital and green resources.

Bricolage Capability (BC): Evaluated using a five-item subset adapted from the original eight-item scale introduced by Senyard, et al. [17], drawing on the foundational concepts established by Baker and Nelson [13] to fit the twin-transition context.

Strategic Agility (SA): Evaluated by a four-item subset adapted from the original scale by Tallon and Pinsonneault [16], this variable assesses the firm's speed and fluidity in reallocating resources amid market volatility.

Sustainable Competitive Advantage (SCA): This ultimate dependent variable is measured utilizing a five-item scale adapted from the validated framework of Li, et al. [26]. To ensure the construct accurately operationalizes "sustainability" rather than a transient market position, the original measurement items were methodologically refined by incorporating a longitudinal prefix ("*Over the past three years...*"). This scale assesses the firm's enduring strategic superiority over its principal rivals across five tangible market-facing dimensions: price competitiveness, product quality, delivery dependability, product innovation frequency, and time-to-market speed.

Control Variables: This study controls for organizational factors that may potentially confound strategic outcomes, including firm size (measured by the total number of employees), firm age (number of operational years since establishment), and industry sector (dichotomized into manufacturing and services).

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Table 1.
Proposed Measurement Scales.

Scale/Variable	Observed variable	Source
Digital Technology Capability - DTC	DTC1: Our firm frequently scans the environment to identify new digital technology trends.	Khin [15]
	DTC2: Our firm invests adequately in digital infrastructure to capture market opportunities	
	DTC3: Our firm effectively integrates digital technologies into core business processes	
	DTC4: Our firm has the capability to digitally transform its business model when required.	
Green Innovation Capability - GIC	GIC1: Our firm chooses less polluting materials for product development	Adapted from Chen, et al. [14]
	GIC2: Our firm ensures that manufacturing processes consume less energy and resources	
	GIC3: Our firm effectively recycles waste and emissions in production	
	GIC4: Our firm can successfully develop eco-friendly or green products	
Resource Orchestration Capability - ROC	ROC1: We systematically structure our resource portfolio to acquire new digital and green assets	Self-developed based on: Carnes, et al. [11] & Sirmon, et al. [12]
	ROC2: We deliberately divest obsolete or non-eco-friendly resources	
	ROC3: We effectively bundle digital technologies with environmental management practices.	
	ROC4: We continuously enrich our existing capabilities to align with twin transition goals	
	ROC5: We dynamically coordinate resources across different departments to leverage market opportunities.	
	ROC6: We successfully deploy integrated digital-green capabilities into new strategic initiatives.	
Bricolage Capability - BC	BC1: We respond to new challenges by combining resources at hand for new purposes.	Self-developed based on: Senyard, et al. [17] & Baker and Nelson [13]
	BC2: We practice making do with what is available rather than waiting for ideal resources.	
	BC3: We resolve resource shortages by utilizing neglected or low-cost alternatives.	
	BC4: We effectively employ cross-trained or multi-tasking personnel to overcome constraints.	
	BC5: We creatively repurpose existing equipment or technologies to implement green/digital practices.	
Strategic Agility - SA	SA1: Our firm can rapidly adapt its strategic direction to market changes.	Tallon and Pinsonneault [16]
	SA2: Our firm easily reallocates resources from underperforming areas to new opportunities.	
	SA3: Our firm detects strategic opportunities and threats faster than competitors.	
	SA4: Our firm possesses high fluidity in switching between alternative strategic plans	
Sustainable Competitive Advantage - SCA	SCA1 (Price/Cost): Over the past three years, our firm has consistently offered more competitive prices than our main competitors.	Li, et al. [26] (Modified with a temporal prefix to capture construct sustainability)
	SCA2 (Quality): Over the past three years, our firm has continuously delivered superior product/service quality and exceptional reliability.	
	SCA3 (Delivery Dependability): Over the past three years, our firm has reliably and precisely fulfilled customer delivery commitments	
	SCA4 (Product Innovation): Over the past three years, our firm has frequently introduced innovative features or products to the market.	
	SCA5 (Time to Market): Over the past three years, our firm has systematically reduced time-to-market for new products/services compared to key rivals.	

3.2. Proposed Data Collection

The target population for this empirical study will comprise enterprises currently operating within Vietnam. To ensure data validity, survey respondents will be strictly limited to key informants;

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specifically, Board of Directors members, C-suite executives, or senior-level managers overseeing technological and environmental strategies. These individuals will be deliberately targeted because they possess the most comprehensive perspective on the organization's overarching resource portfolio and strategic trajectory [11].

To ascertain the minimum sample size requisite for a complex structural model incorporating a three-way moderating effect, this study will employ the inverse square-root method proposed by Kock and Hadaya [27] for PLS-SEM. Assuming a minimum detectable path coefficient of 0.15, the mathematically recommended sample threshold is 275. However, to guarantee robust statistical power and enhance reliability, this research will conservatively target a minimum collection of 300 valid responses.

The data collection strategy will be executed utilizing a purposive convenience sampling approach, leveraging professional networks comprising MBA alumni and executives within business associations to maximize the response rate. The electronic questionnaire will be designed via Google Forms and distributed through email and direct messaging platforms (Zalo). To encourage genuine participation and mitigate social desirability bias, the cover letter will guarantee strict anonymity and offer a complimentary executive summary of the research findings upon the study's conclusion.

To preclude the risks of unqualified respondents and careless responding, the survey will incorporate two rigorous quality-control checkpoints: (1) an initial screening question requiring respondents to verify their managerial rank and level of strategic familiarity; and (2) an attention-check item randomly embedded within the questionnaire (e.g., Please select "Strongly disagree" for this item). Any responses failing either of these criteria will be immediately purged from the raw dataset.

3.3. Proposed Data Analysis

The conceptual model will be empirically evaluated employing Consistent Partial Least Squares Structural Equation Modeling (PLSc-SEM) utilizing SmartPLS software [28]. This advanced algorithm is strictly recommended for models comprising reflectively measured constructs to correct for attenuation biases inherent in traditional PLS-SEM. The selection of PLSc-SEM is justified as the optimal analytical approach for three primary reasons: (1) the model incorporates a complex higher-order interaction structure (specifically, a moderating variable acting upon an interaction term); (2) the PLS algorithm is inherently nonparametric and does not impose stringent assumptions regarding the multivariate normality of the data; and (3) it is highly robust and suitable for the moderate sample sizes characteristically encountered in research targeting senior executives [28]. The overall data analysis procedure will be executed adhering to the standard two-step approach, evaluating the measurement model followed by the structural model, as widely recommended in recent PLS-SEM guidelines by Hair, et al. [29]. Within this framework, the execution of the PLSc-SEM algorithm will be based on Cheah, et al. [28], while specific evaluation criteria, such as discriminant validity, will strictly follow the advancements proposed by Henseler, et al. [30]:

Step 1: Measurement Model Evaluation

Before hypothesis testing, the study will evaluate the reliability and validity of the measurement scales. Internal consistency reliability will be rigorously assessed via Cronbach's alpha, Composite Reliability (CR), and the exact reliability coefficient (Dijkstra's ρ_A), all of which are required to exceed the 0.70 threshold. Convergent validity will be established when the outer loadings of the indicators exceed 0.70 and the Average Variance Extracted (AVE) surpasses the 0.50 threshold. Discriminant validity will be evaluated exclusively utilizing the Heterotrait-Monotrait (HTMT) ratio of correlations, adhering to the recent methodological advancements by Henseler, et al. [30], which demonstrate the severe limitations of the traditional Fornell-Larcker criterion. The procedure strictly requires all HTMT values to be below the 0.85 threshold.

Step 2: Structural Model Evaluation

Following the satisfactory validation of the measurement model's reliability and validity, the structural model will be analyzed to test hypotheses H1 through H5. Potential multicollinearity among

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the predictor variables will be strictly controlled by examining the Variance Inflation Factor (VIF), adhering to a rigorous acceptable threshold of VIF < 3.0 to ensure the stability of the estimations. The study will employ a nonparametric bootstrapping procedure with 10,000 resamples to compute the t-values and ascertain the significance levels of the path coefficients [29]. Subsequently, the explanatory power and effect sizes of the structural model will be assessed via R^2 and f^2 metrics. Crucially, given the adoption of the PLSc-SEM algorithm, the overall model fit will be rigorously evaluated using the Standardized Root Mean Square Residual (SRMR), adhering to the strictly recommended threshold of < 0.08.

Specifically, the direct effects of the independent capabilities (H1, H2), the synergistic interaction effect (H3), and the direct impacts of Resource Orchestration Capability on the two outcome variables (H4a, H4b) will be directly evaluated via standardized path coefficients and their corresponding confidence intervals.

Although H4a and H4b are hypothesized as direct effects, the overarching research model intrinsically encompasses complex endogenous mechanisms. Therefore, to comprehensively elucidate the mediating role of Resource Orchestration Capability (ROC) concerning the overall indirect relationships from the independent variables (DTC, GIC) to the outcome variables (SA, SCA), the study will conduct an analysis of specific indirect effects. This procedure will rely on bias-corrected bootstrapped confidence intervals. Regarding the complex three-way interaction effect of the bricolage moderator (H5) upon the digital and green interaction relationship, the two-stage approach will be applied. This method is strictly recommended by recent PLS-SEM guidelines to accurately estimate higher-order moderations while effectively avoiding severe multicollinearity issues. Ultimately, simple slopes plots will be generated to visually elucidate the nature of the complex three-way moderating relationship across four distinct conditions, representing the combinations of high (+1 SD) and low (-1 SD) levels of both Bricolage Capability and Green Innovation Capability [31].

Finally, given the cross-sectional, single-informant nature of the proposed survey design, the potential for Common Method Bias (CMB) is acknowledged. To address this, beyond procedural remedies such as guaranteeing psychological separation and respondent anonymity, the study will perform rigorous statistical controls as recommended by Podsakoff, et al. [32]. Specifically, Harman's single-factor test and the unmeasured latent method construct (ULMC) approach will be executed before structural modeling to ensure that artifactual covariance does not artificially inflate the hypothesized relationships.

4. Discussion and Theoretical Implications

4.1. Discussion

The proposed research model endeavors to elucidate the endogenous mechanisms and managerial boundary conditions through which enterprises in emerging economies translate digital and green capabilities into strategic advantage. Although this framework currently remains at the conceptual-proposition stage, the logical arguments derived from Resource Orchestration Theory (ROT) and the Theory of Bricolage have unveiled profound discussion perspectives regarding the true nature of the "Twin Transition".

Primarily, the hypothesized direct relationship between the independent capabilities (Digital Technology Capability - DTC and Green Innovation Capability - GIC) and the mediating variable (Resource Orchestration Capability - ROC) reflects an "action imperative" within the enterprise. As a firm escalates its investments in digital infrastructure or ecological processes, it concurrently induces a state of temporary disequilibrium within its existing asset configuration [1]. The influx of novel data streams or the imposition of stringent emission standards precludes top management from maintaining a static managerial mindset. Grounded in ROT [12], these new resources function as strategic stimuli, necessitating the activation of managerial structuring and bundling capabilities to re-establish strategic order.

The second critical locus of discussion revolves around the synergistic interaction effect (DTC × GIC → ROC). In stark contrast to conventional paradigms that perceive digitalization and greening as fiercely competing objectives for finite resources, and aligning with recent visionary perspectives on the twin transition [8, 9, 20], this model anticipates a co-evolutionary dynamic. The hypothesized positive interaction is projected to demonstrate that, when implemented concurrently, digital technology serves as an informational infrastructure, effectively mitigating the search and implementation costs associated with green solutions [9, 20]. Conversely, the imperative for green transition acts as a strategic directional filter, precluding arbitrary and dispersed technological investments. This mutual resonance cultivates a "complex resource ecosystem" within the enterprise, catalyzing resource orchestration capability to attain superior efficacy compared to the isolated pursuit of either strategy.

Ultimately, the incorporation of bricolage capability as a moderating variable upon the interaction effect (H5) serves to demystify the practical conundrum inherent in the Vietnamese context. Amidst the austerity conditions characterizing SMEs, the model is projected to demonstrate that bricolage functions as a vital "alternative engine." When an enterprise faces capital deficits that preclude the execution of resource orchestration processes conforming to resource-intensive global standards, prior literature indicates that bricolage capability empowers them to leverage low-cost or overlooked assets [13, 17]. Building upon this foundation, we posit that it is precisely this bricolage approach that enables resource-constrained SMEs to accomplish the unprecedented digital and green integration mandate. The anticipated simple slopes plot is expected to empirically visualize a unique marginal effect: the higher the bricolage capability, the less vulnerable the enterprise becomes to financial constraints during the implementation of the twin transition.

4.2. Theoretical Implications

The proposed model offers three fundamental theoretical contributions to contemporary Strategic Management literature:

First, it extends and enriches Resource Orchestration Theory (ROT) within the era of the twin transition. The preponderance of prior research applying ROT has conventionally gravitated toward traditional operational resources, such as supply chain management capabilities or isolated R&D investment portfolios [11]. This study pioneers the expansion of ROT's theoretical boundaries by incorporating a highly complex macroeconomic phenomenon into the analysis: the digital-green convergence. By conceptualizing Resource Orchestration Capability (ROC) as the indispensable mediating "black box" required to cultivate Strategic Agility, this research challenges the dogmatic, static nature of the traditional Resource-Based View [10]. Ultimately, it asserts that, in the digital and ecological era, managerial "orchestration actions" hold superior theoretical significance compared to the mere "possession" of assets.

Second, it dismantles the fragmented disciplinary divide between the Information Systems (IS) and Environmental Management domains. Historically, management research has often treated technological performance and ecological legitimacy as parallel rather than intersecting domains. To address this persistent intellectual siloing, the proposed model proffers an integrated framework, providing empirical substantiation that these two capability streams are not mutually exclusive. Instead, the author argues that they must be conceptualized and investigated as synergistically co-evolving capabilities within a modern configurational framework. Consequently, this research serves as a rigorous academic response to the explicit call by Muench, et al. [3] for transdisciplinary research and integrated frameworks capable of explicating the complex interlinkages within the "twin transition" phenomenon.

Third, it establishes a novel paradigm for strategic management within resource-constrained environments. Classical strategic management theories are predominantly permeated by a "Western context bias," wherein foundational research assumptions inherently presume that enterprises possess unhindered access to abundant capital and mature institutional frameworks [6, 7]. By integrating the Theory of Bricolage as a three-way moderator, this research reconfigures existing theoretical

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boundaries: resource limitations in emerging markets, such as Vietnam, do not merely constitute detrimental barriers; rather, they can function as catalytic mechanisms that trigger breakthrough innovative thinking [18]. Ultimately, this contributes a profoundly localized perspective, a vital endeavor in "contextualized theory building," to the global academic discourse.

4.3. Limitations and Future Research

Notwithstanding its prospective theoretical contributions, the proposed model is not without three core limitations, which simultaneously delineate promising avenues for future research:

First, the absence of empirical validation at the current stage. Given that the present study culminates in the establishment of a conceptual framework and the formulation of hypotheses, all proposed causal relationships remain confined to the realm of "theoretical expectations" and have yet to be empirically corroborated by real-world market data. *Future research directions*: The imperative next step entails executing a large-scale data collection procedure via field surveys encompassing enterprises operating in Vietnam. Subsequently, employing the PLS-SEM analytical approach as delineated in the Methodology section will be essential to empirically validate hypotheses H1 through H5.

Second, the inherent temporal constraints of the proposed cross-sectional data design. Inherently, the processes of resource orchestration and strategic realignment constitute a temporally unfolding sequence of actions. Even when employing time-lagged procedural remedies (e.g., temporal separation between T_0 and T_1) as methodologically recommended for future data collection, questionnaire-based survey data may still struggle to fully encapsulate the dynamic organizational evolution. *Future research directions:* Subsequent studies could adopt longitudinal in-depth case study methodologies or compile objective panel data by integrating financial and ESG reports. Such methodological advancements would empower scholars to rigorously track the firm's twin transition trajectory over a 3- to 5-year longitudinal horizon.

Third, the constraints regarding national context representativeness and generalizability. The proposed research design is deeply embedded within the idiosyncratic institutional and economic architecture of Vietnam, a transitional, socialist-oriented market economy. Consequently, any future empirical findings derived from this proposed model may be inherently intertwined with Vietnam's unique cultural dimensions and policy idiosyncrasies, thereby circumscribing the generalizability of the results to other geographical contexts. *Future research directions*: Subsequent scholarship should endeavour to extend this framework by executing cross-national comparative studies. Expanding the empirical scope across diverse ASEAN member states or other emerging economies characterized by varying degrees of "institutional voids" would be instrumental in ascertaining the global robustness and boundary conditions of the bricolage moderating effect.

Transparency:

The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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