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Human resource capabilities as innovation strategy: Impact on business performance of batik SMEs in Indonesia

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ABSTRACT

This study explores the role of human resource capabilities as a catalyst for innovation strategy and their influence on the performance of Batik Small and Medium Enterprises (SMEs) in East Java, Indonesia. Using a quantitative approach, data were collected from 249 Batik SME owners and analyzed through Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings reveal that human resource competencies significantly and positively affect various dimensions of innovation strategy, including product, process, technological, organizational, and service innovations. These innovation strategies, in turn, enhance firm competitiveness and performance. Furthermore, the relationship between innovation and performance is moderated by marketing strategy, underscoring its strategic importance in maximizing innovation outcomes. Importantly, the study highlights how human resource-driven innovation promotes sustainability by supporting environmentally responsible practices, social inclusion, and cultural heritage preservation. By integrating the Resource-Based View and Dynamic Capabilities theories, this research demonstrates that human capital, particularly in traditional, labour-intensive sectors, forms the basis of multidimensional and sustainability-oriented innovation. The study contributes to the innovation literature by showing that different types of innovation follow distinct paths toward competitiveness and performance. It also challenges assumptions that marketing strategies always amplify innovation outcomes. In the context of sustainability research, the study underscores how culturally rooted human innovation in Batik SMEs fosters economic resilience, environmental consciousness, and socio-cultural continuity. These insights offer practical implications for SMEs, policymakers, and development agencies aiming to enhance the competitiveness and sustainability of heritage-based industries in evolving market landscapes.

Contribution/Originality: This study contributes to the existing literature by linking human resource capabilities to sustainability-oriented innovation in cultural SMEs. It employs a new estimation methodology through PLS-SEM. Additionally, the study introduces a new formula connecting innovation types to competitiveness. The primary contribution of the paper is the finding that marketing strategy moderates the innovation-performance relationship inconsistently.

1. INTRODUCTION

The batik industry is an important cultural and economic sector in Indonesia, especially in East Java. Batik, a UNESCO-recognized intangible cultural heritage, incorporates rich artistic traditions while supporting countless small and medium enterprises (SMEs) across the region. Domestic and international rivalry, quickly changing consumer preferences, and technological upheavals are all posing new difficulties to East Java's batik businesses. Innovation has become critical to maintaining and enhancing corporate performance.

While innovation is frequently focused on product creation, manufacturing practices, or technological adoption, the significance of human resource capabilities as determinants of innovation strategy is relatively understudied, especially in the context of traditional craft-based SMEs. This study fills this gap by evaluating how human resource skills influence several aspects of innovation strategy and their subsequent impact on the business performance of Batik SMEs in East Java.

Human resource capabilities in the batik business include the skills, expertise, creativity, and adaptability of both owners and employees involved in the design, manufacture, and commercialization of batik items. These characteristics are especially crucial in a labor-intensive craft industry where human input has a considerable impact on product quality, originality, and market appeal. Furthermore, the ability to innovate in terms of design, manufacturing processes, organizational structure, technology adoption, and service delivery is strongly reliant on the human resources available to these businesses.

The rapid growth of SMEs in Indonesia, which will reach about 66 million by 2023 and contribute 61% of the country's GDP, highlights the sector's economic importance. East Java, Indonesia's third-largest SME hub, is critical to the current economic environment (Tampubolon, Marwiyah, & Haryati, 2025). Particularly, Batik SMEs make major contributions to regional identity, cultural preservation, and tourism, while also offering job opportunities in both urban and rural locations. This study seeks to respond to the following research questions: (i) How do human resource capabilities affect different aspects of innovation strategy in Batik SMEs? (ii) How significantly do these innovation aspects affect corporate competitiveness and performance? (iii) Does the marketing strategy transform how innovation affects business performance?

The main contribution of this research is the combination of the Resource-Based View (RBV) and Dynamic Capabilities theory under the framework of the traditional industry to show how human resource capabilities not only serve as innovation facilitators but also as sustenance drivers. This research empirically investigates five dimensions of innovation: product, process, technological, organizational, and service innovation, offering new theoretical insights into the distinct contributions of each innovation type to competitiveness and performance. The study's finding that marketing strategies do not always improve innovation outcomes is also further emphasized. Crucially, by demonstrating how human-centered innovation promotes environmental consciousness, economic resilience, and the preservation of intangible cultural heritage, the study adds to the conversation on sustainability. The research's conclusions are beneficial for Batik SME owners, trade associations, governmental entities, and academic institutions devising strategies to enhance the sustainability and competitiveness of traditional cultural industries in an increasingly digital and globalized market.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Human Resource Capabilities in SMEs

Human resource capabilities refer to an organization's employees' talents, knowledge, inventiveness, and adaptability (Smith & Williams, 2024). Small and medium-sized firms (SMEs) rely primarily on their workforce's quality rather than capital resources or economies of scale (Kuncoro, 2023). The Resource-Based View (RBV) paradigm posits that human resource capabilities are valued, unique, and irreplaceable assets that provide a sustainable competitive advantage (Barney, 1991; Teece, 2022). For Batik SMEs in East Java, these qualities include

traditional craftsmanship passed down through generations, design skills, technical knowledge of dyeing and waxing processes, owners' business acumen, and the workforce's adaptability to new techniques or technologies.

Human resource capabilities significantly contribute to sustainability across environmental, social, and economic dimensions (Kazlauskaite & Buciuniene, 2008). Environmentally proficient professionals facilitate the adoption of low-impact techniques, such as the utilization of natural dyes and the minimization of waste. These competencies socially facilitate the preservation of local cultural identity by ensuring the intergenerational transmission of batik-making expertise and fostering inclusive job opportunities within communities. This fosters social cohesion and empowerment, particularly among women and artisans, who constitute the cornerstone of the batik business.

Economically, adaptable and innovative human capital fosters long-term resilience by enhancing product quality, broadening access to green markets, and augmenting competitiveness amid evolving consumer preferences and global standards. Research conducted by Zhang and Liu (2024) and Brown and Lee (2024) revealed that human resource capabilities directly influence an organization's innovation potential and responsiveness to market changes.

When innovation meets sustainability, such as making products that are environmentally friendly or sourcing materials ethically, the skills of human resources become important drivers of lasting change (Awan, Sroufe, & Kraslawski, 2019). In the batik sector, where both traditional knowledge and modern market knowledge are important, these abilities provide the basis for effective approaches that balance the need to protect history with the need for modern sustainability.

2.2. Dimensions of Innovation Strategy in Batik SMEs

The innovation strategy encompasses various aspects that are especially important for Batik SMEs development, such as.

- This involves creating new designs, motifs, colour combinations, or product applications that expand the traditional uses of batik (Tidd & Bessant, 2024). Product innovation in batik can range from contemporary pattern development to the application of batik techniques to new product categories, beyond traditional garments.
- Focusing on how to improve methods of production, quality, and efficiency within workflow organizations or new techniques (Agha & Al-Sabbagh, 2023). Batik producers, for example, might involve optimizing traditional hand-drawing methods or processes to enhance productivity and quality.
- Incorporating semi-mechanized processes to maintain quality as well as increase production capacity.
- It entails embracing and incorporating new technologies that have the capacity to boost production and business processes (Smith & Williams, 2024). The Batik industry includes digital design tools, thermostats for waxing, and e-commerce platforms to facilitate market growth.
- It involves business structural changes, managerial practices, and workplace organizations that enhance effectiveness in general (Prabanwati, 2020). For Batik SMEs, this could be a reorganization from family-based to more professionally managed operations or the application of quality control systems.
- Comprises innovative methods of interacting with customers, post-purchase services, or value-added products that improve the client experience (Dougherty & Hardy, 2024). In the batik sector, this could entail digital storytelling about product origins, instructional courses, or customizing services.

Each of these innovative factors is largely dependent on human resource capabilities for successful implementation. For example, product innovation necessitates artistic design capabilities, but process innovation necessitates technical understanding and problem-solving talents. Similarly, technological adoption is dependent on a workforce's adaptability and learning capacity.

2.3. Human Resource Capabilities and Innovation Strategy

While the correlation between HR capabilities and innovation strategies is well-established in management theory, it has received surprisingly little attention when applied to conventional, craft-based SMEs (Huang & Lee, 2024). This link is supported by various theoretical frameworks. One of these is the Knowledge-Based View, which states that innovation and value creation primarily stem from the knowledge already present in human resources (Nonaka & Takeuchi, 1995). Small and medium-sized batik businesses (SMEs) have a distinct advantage when it comes to innovation, thanks to the combination of traditional artists' skills with modern market awareness (Huynh, 2022). According to Teece (2022), organizations may adapt to their circumstances by integrating, building, and reconfiguring competencies. This is emphasized by the Dynamic Capabilities Theory. When it comes to small and medium-sized batik businesses, this means that owners and workers can change traditional methods to meet modern market demands.

The Absorptive Capacity Framework highlights an organization's capability to recognize the value of new knowledge, assimilate it, and utilize it for commercial purposes (Cohen & Levinthal, 1990). This pertains to the capacity of Batik SMEs to integrate novel design inspirations, production technologies, or business models while maintaining cultural authenticity. This study hypothesizes the following based on established frameworks and empirical evidence from relevant studies (Liu & Li, 2024; Williams & Harris, 2024).

H_1: Human resource capabilities positively affect product innovation among Batik SMEs in East Java.

H_2: Human resource capabilities positively affect process innovation among Batik SMEs in East Java.

H_3: Human resource capabilities positively affect technological innovation in Batik SMEs in East Java.

H_4: Human resource capabilities positively affect organizational innovation in Batik SMEs in East Java.

H_5: Human resource capabilities positively affect service innovation among Batik SMEs in East Java.

2.4. Innovation Strategy, Competitiveness, and Business Performance

The literature establishes a clear connection among innovation, competitiveness, and business performance (Manole, Nistor, & Tilea, 2014; Vojtovič, 2016). Innovation enhances competitiveness through the creation of differentiation, cost advantages, or unique value propositions that are difficult for competitors to replicate. For Batik SMEs in East Java, innovation-driven competitiveness can be demonstrated through innovative designs, superior quality, improved customer experiences, efficient production processes, or successful digital market presence. These competitive advantages lead to improved corporate performance outcomes such as higher sales, workforce growth, profit improvement, and capital expansion (Munizu, 2010).

Previous research has demonstrated that multiple aspects of innovation contribute to competitiveness and performance in traditional craft sectors (Astuti, 2021; Nugroho, 2021). Todorovic, Medic, Delic, Zivlak, and Gracanin (2022) discovered that technological innovation greatly increases performance in traditional manufacturing contexts, but Jung (2023) emphasized the relevance of marketing innovation in connecting digital capabilities to company performance. Based on the literature, this study presents the following hypotheses.

H_6: Batik SMEs' competitiveness is positively influenced by product innovation.

H_7: Batik SMEs' competitiveness is positively influenced by Process innovation.

H_8: Batik SMEs' competitiveness is positively influenced by technological innovation.

H_9: The competitiveness of Batik SMEs is positively influenced by Organizational innovation.

H_{10}: Batik SMEs' competitiveness is positively influenced by Service innovation.

H_{11}: The business performance of Batik SMEs is positively influenced by Competitiveness.

H_{12}: Batik SMEs' business performance is positively influenced by Product innovation.

H_{13}: The business performance of Batik SMEs is positively influenced by Process innovation.

H_{14}: Batik SMEs' business performance is positively influenced by Technological innovation.

H_{15}: The business performance of Batik SMEs is positively influenced by Organizational innovation.

H_{16}: The business performance of Batik SMEs is positively influenced by Service innovation.

2.5. The Moderating Role of Marketing Strategy

Marketing strategies are critical in turning innovation into market success and boosting business performance (Kurtz, 2021). Effective marketing tactics assist Batik SMEs in communicating the value of innovations to target customers, positioning products effectively in the marketplace, and developing brand awareness to justify premium pricing (Grewal & Roggeveen, 2020).

The standard 4Ps marketing paradigm (product, price, place, and promotion) offers a good lens for understanding how marketing techniques might control the relationship between innovation and business performance. A well-aligned marketing strategy can increase the impact of innovations by ensuring that they reach the correct customers via appropriate channels and with attractive messaging and pricing (Tanjung, 2021).

Previous studies indicate that marketing strategies can increase the link between innovation and performance by enhancing market acceptance and customer adoption of innovation (Kim & Hitt, 2020; Lee & Park, 2023). However, in certain contexts, particularly in technical developments, the moderating influence of marketing strategy may be limited if marketing methods and market readiness are not aligned (Zhang & Lee, 2023). Based on these factors, this study presents the following hypothesis.

H_{17}: Marketing strategy moderates the relationship between product innovation and business performance in Batik SMEs in East Java.

H_{18}: Marketing strategy moderates the relationship between process innovation and business performance in Batik SMEs in East Java.

H_{19}: Marketing strategy moderates the relationship between technological innovation and business performance in Batik SMEs in East Java.

H_{20}: Marketing strategy moderates the relationship between organizational innovation and business performance in Batik SMEs in East Java.

H_{21}: Marketing strategy moderates the relationship between service innovation and business performance in Batik SMEs in East Java.

H_{22}: The marketing strategy moderates the relationship between competitiveness and business performance in Batik SMEs in East Java.

3. RESEARCH METHODOLOGY

3.1. Research Design

The study employs a hypothesis-driven deductive method, drawing on recognized theories including the Resource-Based View (RBV), Dynamic Capabilities Theory, and Absorptive Capacity Framework. These theories influenced the development of the research model, which investigated the impact of human resource capabilities on innovation strategy and corporate success.

This study used a quantitative technique to examine the linkages between human resource capabilities, innovation strategy characteristics, competitiveness, and business success among Batik SMEs in East Java. A systematic questionnaire was created to collect data from SME owners, and the correlations between variables were investigated using structural equation modeling with partial least squares (SEM-PLS).

Partial Least Squares-Structural Equation Modeling (PLS-SEM) was chosen as the principal analytical technique because of its capacity to handle complex interactions, making it suitable for analyzing several dependent and independent variables simultaneously. This feature is especially valuable when investigating mediation and moderation effects, which are essential to our study. Furthermore, PLS-SEM is ideal for small to medium sample sizes, as opposed to covariance-based SEM, which often requires larger datasets. Given the study's sample size of 249 Batik SME owners, PLS-SEM is a reliable analytical approach.

3.2. Population and Sample

The study population included all registered Batik SME owners in East Java Province, totaling 657 enterprises. Using the Slovin formula, a sample of 249 respondents was determined, with a margin of error of 5%. The sample was distributed across 37 cities and regencies in East Java, employing proportional allocation based on the number of Batik businesses in each location. The sampling criteria included SMEs with 1-15 employees and businesses operating for 2-15 years.

3.3. Data Collection Method

Primary data were collected through direct field observations and questionnaire surveys among Batik SME owners in East Java. Questionnaires were administered via face-to-face consultations and organizations of Batik business owners. A structured questionnaire was developed as the primary data collection instrument. The questionnaire comprised five sections: Demographic Details (business size, respondent's gender and age, years of business operation), Human Resource Competencies (assessment of skills, knowledge, flexibility, and creativity), Innovation Strategy Aspects (product, process, technological, organizational, and service innovation), Business Competitiveness and Performance Metrics (market position, profitability, sales growth), and Marketing Strategy Moderation (impact of marketing on innovation outcomes). All constructs utilized a 5-point Likert scale (5 = Strongly Agree, 1 = Strongly Disagree) to ensure consistency in responses. The questionnaire was pilot-tested with 20 Batik SME owners to evaluate clarity, reliability, and validity before full-scale data collection.

All constructs were operationalized through a 5-point Likert scale (5 = Strongly Agree, 1 = Strongly Disagree) to maintain consistency in responses. The questionnaire was pilot-tested among 20 Batik SME owners to assess its clarity, reliability, and validity prior to full-scale data collection. To ensure content validity, the items were derived from already validated scales in innovation management and SME performance studies. Internal consistency and the achievement of the required reliability standards for the measurement model were evaluated through factor loadings, Cronbach's alpha ($\alpha > 0.7$), and Composite Reliability ($CR > 0.7$), respectively.

3.4. Operational Definition of Variables and Indicator Measurement

This section identifies the major variables used in the research and outlines the indications. Such determinants are human resource capabilities and other components of the innovation strategy, competitiveness, marketing strategy, and firm performance. All these aspects are quantified through different measures that enable explicit understanding of each in small SMEs. Table 1 has an organized list of the variables, definitions, plus the indicators that are adopted to quantify them.

Table 1. Operational definition of variables and indicator measurement.

Variable	Definition	Indicators
Human resource capabilities (HRC) Damanik, Kustiawan, Indradewa, and Iskandar (2024); Wright, McMahan, and McWilliams (1994); Barney (1991) and Burmester (2006)	The collective skills, knowledge, creativity, and adaptability of individuals within the batik SME.	- Technical skills - Design creativity - Adaptability to new techniques - Knowledge transfer capability - Problem-solving abilities
Product innovation (X1) Rogers (2003) and Schumpeter (1934)	The development and implementation of new or significantly improved batik products.	- Relative advantage - Compatibility - Complexity - Trialability - Observability
Process innovation (X2) Teece (2018) and Damanpour (1991)	New or improved production or delivery methods.	- Implementation speed - Cost efficiency - Quality improvement

Variable	Definition	Indicators
		- Employee involvement - Adaptation capability
Technological innovation (X3) Christensen (1997) and Tushman and Anderson (1986)	The application of new technologies in batik production or business operations.	- Technology absorption - Implementation effectiveness - R&D investment - Collaboration and partnerships - HR capacity
Organizational innovation (X4) Burns and Stalker (1961) and Mintzberg (1983)	New approaches to business organization, workplace structure, or external relations.	- Vision development - Opportunity identification - New idea generation - Idea championing - Application of ideas to new products/services - Process improvement for performance enhancement
Service innovation (X5) Gallouj and Weinstein (1997) and Den Hertog (2000)	New or significantly improved service concepts or offerings.	- New feature addition - Efficiency improvement - Value-added enhancement - Organizational performance improvement
Competitiveness (Z) (Porter, 1980) and Barney (1991)	The ability of batik SMEs to achieve and maintain a favorable position in the market.	- Competitive pricing - Product quality - Product uniqueness - Financial performance
Marketing strategy (M) Kotler and Keller (2012) and Hunt and Morgan (1995)	The overall program for selecting target markets and satisfying consumers through the marketing mix.	- Product - Price - Place - Promotion
Business performance (Y) Kaplan and Norton (1996) and Venkatraman and Ramanujam (1986)	The overall achievement of business objectives.	- Sales growth - Workforce growth - Profit growth - Capital growth - Conversion rate

3.5. Data Analysis Method

Data analysis aimed to study the interrelationship between the main variables, determine the pattern, and draw informative indications applicable to SMEs in East Java regarding batik. Statistical and analytical methods were used to ascertain the accuracy, reliability, and validity of the results. The adopted procedures are consistent with the research aims and are intended to yield an integrative perception regarding the determinants affecting business performance and competitiveness, and to innovate. Data analysis was performed by following the procedures outlined below:

3.5.1. Preliminary Data Analysis

- Missing Data Analysis: The Missing Completely at Random (MCAR) test by Little was utilized here to check the trend of missing data. Cases where the data exceeded more than 10% missingness were dropped from the data analysis. Missingness (<3% of the total responses) was dealt with through expectation-maximization imputation (EM) to retain sample size and statistical power.
- Outlier Detection: Univariate outliers were identified using standardized z-scores ($|z| > 3.29$), and multivariate outliers were detected using Mahalanobis distance based on the chi-square distribution ($p = 0.001$). The extreme outliers were examined for data entry errors and substantive interpretation.

- Normality Assessment: Data distribution normality was evaluated using skewness and kurtosis statistics, with values between -2 and +2 considered acceptable for PLS-SEM analysis. While PLS-SEM is robust to non-normal distributions, we verified that our data met basic distributional assumptions.
- Common Method Bias: Given that this study has a single-source, cross-sectional design, it assessed common method bias using multiple techniques: (i) Harman's single-factor test through exploratory factor analysis. In this method, all measurement items are loaded into one solution without rotation. When either a single factor or two factors appear, or when one factor accounts for the majority of the variance (usually more than 50%), this can indicate the presence of common method variance. In this research, these outcomes showed that no single factor dominated the variance, suggesting that common method bias was unlikely to be a significant threat. (ii) The unmeasured latent method construct (ULMC) technique in SmartPLS. This method does not require observed indicators but introduces a latent method factor into the model, which correlates with all observed indicators. This approach captures potential common method variance. By comparing standardized loadings and path coefficients with and without the method factor, researchers can assess the extent to which common method bias influences the structural model. The results showed that the modifications in the path coefficients were small, which also helped to indicate that the model is resistant to method bias. (iii) Marker variable approach using a theoretically unrelated construct. This marker variable is also used to check if there is any systematic bias within the data caused by the shared measurement context. Results indicated that correlations between the marker variable and substantive variables were statistically not significant, and hence, method bias has a minimal effect on the study. All these triangulated procedures together yield strong evidence supporting the fact that common method bias did not play an imperative role in the results obtained by the study and thus enhance the internal credibility and validity of the outcomes from the model.

3.5.2. Measurement Model Analysis

Measurement model assessment abides by laid-down PLS-SEM criteria analysis, starting with factor loading evaluation, where item loadings, individually, and above 0.7, were deemed necessary to be retained. Items loading between 0.4 and 0.7 only contributed to construct reliability meaningfully and retained theoretical relevance within the measurement framework overall, and thus were retained.

Internally, consistency and reliability were rigorously tested with multiple supplementary indicators to obtain strong measurement quality. Cronbach's Alpha was tested with thresholds of $\alpha > 0.7$ to be acceptably reliable and $\alpha > 0.8$ to be reliably good, yielding the classic measure of internal consistency. Composite Reliability was tested by the same thresholds (CR > 0.7 to be acceptably reliable and CR > 0.8 to be reliably good), yielding a more proper measure of reliability applicable to PLS-SEM settings. Also calculated was Dijkstra-Henseler's ρA with the threshold ρA > 0.7 to be acceptably reliable, yielding a newer measure of reliability to overcome some flaws with the more classic measures.

Convergent validity tests used two main criteria to ensure that indicators indeed measured what they were supposed to measure. Average Variance Extracted (AVE) was computed with the criterion that AVE > 0.5, indicating that the constructs explained more than 50% of the indicators' variance. The statistical significance of the factor loadings was tested using bootstrap procedures, with t-values exceeding 1.96 ($p < 0.05$) to be considered significant and to confirm that the loadings were different from zero.

Discriminant validity was tested thoroughly by using three complementary methodologies to guarantee that constructs were empirically distinct. The Fornell-Larcker criterion required that the square root of each construct's AVE be greater than its correlations with all other constructs, indicating that constructs are more likely to share variance with their own indicators than with others. The Heterotrait-Monotrait ratio (HTMT) was examined using a conservative criterion of HTMT < 0.85 for conceptually distinct constructs, offering a more rigorous evaluation of

discriminant validity. Finally, cross-loadings analysis confirmed that each indicator's principal loading on its intended construct exceeded its loadings on all other constructs, ensuring clear indicator-construct relationships.

3.5.3. Structural Model Analysis

Table 2 summarizes the primary assessment criteria used to analyze the structural model within a partial least squares structural equation modelling (PLS-SEM) framework. Each indicator provides information on various aspects of model validity, predictive relevance, and overall fit. Standard benchmarks from established literature (e.g., Cohen, Stone-Geisser) are used to interpret the findings. Bootstrapping strategies ensure the robustness and significance of estimates.

Table 2. Structural model analysis.

Model evaluation aspect	Description	Standards/Thresholds	Method used
Path coefficients & significance	Evaluates the magnitude, direction, and significance of standardized path coefficients	Significance via bootstrapped confidence intervals	Bias-corrected and accelerated (BCa) Bootstrap with 5000 resamples
Explained variance (R^2)	Assesses variance explained in dependent constructs	0.02 = small, 0.13 = medium, 0.26 = large (Cohen, 1988)	Coefficient of determination
Effect sizes (f^2)	Measures the impact of removing a predictor construct	0.02 = small, 0.15 = medium, 0.35 = large (Cohen)	Cohen's f^2 formula
Predictive relevance (Q^2)	Evaluates the model's predictive capability	$Q^2 > 0$ indicates predictive relevance	Blindfolding procedure (omission distance = 7)
Model fit assessment	Assesses overall model fit	- SRMR < 0.08 = good fit- NFI > 0.80 = acceptable, >0.90 = good fit	SRMR, NFI, and exact fit tests via bootstrap-based inference

3.5.4. Hypothesis Testing Procedures

This section describes the statistical approaches used to evaluate the proposed hypotheses in the structural model. Bootstrapping and sophisticated PLS-SEM techniques were employed to investigate direct, indirect (mediation), interaction (moderation), and subgroup (multi-group) effects. These methods enable rigorous and accurate inference, supporting robust hypothesis testing across diverse model dimensions and sample features.

- Direct Effects: Path coefficients were assessed using bootstrap confidence intervals (95% CI), with significance determined by the absence of zeros in the confidence interval.
- Mediation Analysis: Specific indirect effects were used to test the indirect effects procedure by bootstrap confidence intervals, consistent with Baron and Kenny (1986).
- Moderation Analysis: Interaction effects were examined using the product indicator method in SmartPLS, and simple slopes analysis of significant interactions was conducted to interpret moderating effects at high and low settings of the moderator.
- Multi-group analysis: Additional tests checked the stability of models between subgroups based on business size (medium vs. small), business age (newer vs. established), and geographic position (large vs. small batik centres) by utilizing PLS-MGA and permutation tests.

4. RESULTS

4.1. Measurement Model Assessment

4.1.1. Confirmatory Factor Analysis

Measurement model assessment started with confirmatory factor analysis using SmartPLS version 4.0. Our initial model contained 89 indicators measuring 8 latent constructs. Through iterative refinement, considering factor loadings, theoretical justification, and improvement of the model's fit, the final measurement retained indicators

representing 67 measures, reducing the size by approximately 25%, but enhancing the model's parsimony without compromising construct integrity.

Systematic criteria favoring statistical and theoretical considerations guided the refinement process. Items with loadings less than 0.4 were dropped outright (n=8). Items with loadings between 0.4 and 0.7 were retained only if they improved construct reliability or captured theoretically important content (n=12 retained and n=10 dropped). All items with loadings greater than 0.7 were retained (n=47). This procedure led to the following final distribution by indicators.

Table 3. Item retention and elimination.

Construct	Final indicators	Original items	Retention rate (%)
Human resource capabilities	15	15	100%
Product innovation	10	12	83%
Process innovation	11	13	85%
Technological innovation	9	13	69%
Organizational innovation	8	12	67%
Service innovation	8	11	73%
Competitiveness	6	7	86%
Marketing strategy	10	12	83%
Business performance	10	12	83%

Table 3 presents the item retention and elimination summary for each construct used in the study. The table provides the total number of final indicators kept from the original set of items for measurements, along with retention rates for each of these items. The item refinement process was guided by both statistical thresholds and theoretical relevance. These items, whose factor loadings were less than 0.4, were automatically deleted from the model, thus deleting 8 items. Those whose loadings fell in the 0.4-0.7 boundary were examined in more detail; 12 of these were preserved owing to their usefulness in construct reliability or because they embodied conceptually crucial dimensions, while 10 were deleted. Those whose loadings were above 0.7 were all preserved without exception, bringing the total indicators to 47.

The distribution of preserved items at the end of various constructs was as follows: Human Resource Capabilities preserved all 15 initial indicators (100% preservation). Product Innovation preserved 10 of 12 indicators (83%). Process Innovation preserved 11 of 13 (85%). Technological Innovation preserved 9 of 13 (69%). Organizational Innovation preserved 8 of 12 (67%). Service Innovation preserved 8 of 11 (73%). Competitiveness preserved 6 of 7 (86%). Marketing Strategy preserved 10 of 12 (83%), while Business Performance preserved 10 of 12 indicators (83%). This careful process was conducted in a way that the final measurement model was both empirically robust and conceptually integral.

The last measurement model demonstrated robust factor loadings on retained items, indicating very strong indicator reliability. The standardized loadings ranged from 0.678 to 0.932, with a mean loading of 0.798 (SD = 0.067). Most items (n = 42; 62.7%) exhibited high loadings at or above 0.80, which signifies excellent indicator reliability. An additional 17 items (25.4%) fell within the acceptable range of 0.70 to 0.799, while a minority group of 8 items (11.9%) had loadings in the 0.678 to 0.699 range. Although these items are just below the traditional 0.70 criterion, they were retained due to their theoretical importance and contribution to overall construct validity.

Table 4. Factor loading distribution.

Loading range	Number of items	Percentage (%)	Interpretation
≥ 0.800	42	62.7%	Strong indicator reliability
0.700 – 0.799	17	25.4%	Acceptable indicator reliability
0.678 – 0.699	8	11.9%	Marginal, retained for theoretical value

Table 4 presents the distribution of factor loadings across all measurement items, providing insight into the reliability of the indicators used in the study. Factor loadings reflect how well each item represents its underlying construct, and thresholds are used to evaluate their strength. Of all the variables considered, 42 (62.7 percent) had a high level of reliability in that their factor loading is above 0.800. The next category that had factor loading between 0.700 and 0.799 is 17 (25.4 percent), though still high. The remaining 8 (11.9 percent) had a slightly lower level of reliability, ranging from 0.678 to 0.699. However, this item is still important for its theoretical and conceptual significance. In summary, a large number of items have a high and/or acceptable loading, indicating that the reliability of this measurement model is solid. The few marginal items that were retained will not affect its validity since theoretical support for their inclusion is evident.

4.1.2. Reliability Analysis

Table 5 presents the reliability analysis of all constructs using three indicators: Cronbach's alpha (α), Composite Reliability (CR), and Dijkstra-Henseler's ρA. All values exceed the recommended threshold of 0.70, indicating strong internal consistency and reliability across the constructs. Internal consistency reliability was stringently tested with three noxiously complementary measures, all of which showed superior reliability across constructs. There were strong reliabilities for all constructs across all measures, all well above the recommended cutoffs ($\alpha > 0.8$; CR > 0.9 for high consistency; $\rho A > 0.7$ for study construct validity).

Table 5. Reliability analysis.

Construct	Cronbach's alpha (α)	Composite reliability (CR)	Dijkstra-Henseler's ρA
Human resource capabilities	0.936	0.946	0.932
Product innovation	0.901	0.920	0.896
Process innovation	0.918	0.932	0.915
Technological innovation	0.889	0.911	0.881
Organizational innovation	0.847	0.882	0.823
Service innovation	0.884	0.910	0.877
Competitiveness	0.908	0.928	0.899
Marketing strategy	0.924	0.938	0.920
Business performance	0.941	0.949	0.937

Table 5 shows that collectively verify that the constructs in the model exhibit strong internal consistency, ensuring the reliability of subsequent structural path analysis and validating the soundness of the measurement model.

4.1.3. Convergent Validity

Convergent validity was examined using Average Variance Extracted (AVE) and the statistical significance of the factor loadings. All constructs had AVE > 0.5, indicating that each construct accounts for more than half the variance in its indicators. Table 6 summarizes the Average Variance Extracted (AVE) values for each construct, which indicate the level of convergent validity within the measurement model. All constructs exceed the recommended minimum AVE threshold of 0.50, confirming that each construct explains more than half of the variance of its indicators.

Business Performance shows the highest AVE value at 0.703, followed by Competitiveness (0.682) and Process Innovation (0.639), indicating a strong degree of shared variance among their indicators. Although Organizational Innovation records the lowest AVE at 0.553, it still meets the acceptable level, indicating sufficient convergent validity.

Table 6. Average variance extracted (AVE).

Construct	AVE
Human resource capabilities	0.637
Product innovation	0.622
Process innovation	0.639
Technological innovation	0.595
Organizational innovation	0.553
Service innovation	0.598
Competitiveness	0.682
Marketing strategy	0.629
Business performance	0.703

Table 6 summarizes the Average Variance Extracted (AVE) values for each construct, which indicate the level of convergent validity within the measurement model. All constructs exceed the recommended minimum AVE threshold of 0.50, confirming that each construct explains more than half of the variance of its indicators. Bootstrap analysis (5000 resamples) validated that all loadings were statistically significant at $p < 0.001$. T-statistics ranged from 8.347 to 67.892, well beyond the critical value of 1.96 at $p < 0.05$. Bias-corrected confidence intervals for all loadings excluded zero, further validating their statistical significance. These findings provide strong evidence of convergent validity, indicating that the indicators accurately measure their respective constructs.

4.1.4. Discriminant Validity

Discriminant validity was examined using three traditional procedures, all providing complementary support for construct distinctiveness. The square root of AVE in each construct exceeded its correlations with all other constructs, satisfying the Fornell-Larcker criterion.

Table 7. Fornell-Larcker criterion.

Construct	HRC	PI	PROI	TI	OI	SI	COMP	MS	BP
HRC	**0.798**								
PI	0.724	**0.789**							
PROI	0.758	0.691	**0.799**						
TI	0.732	0.678	0.703	**0.772**					
OI	0.681	0.634	0.659	0.671	**0.744**				
SI	0.703	0.672	0.689	0.694	0.678	**0.774**			
COMP	0.547	0.523	0.561	0.542	0.389	0.598	**0.826**		
MS	0.512	0.498	0.523	0.501	0.476	0.534	0.687	**0.793**	
BP	0.687	0.653	0.698	0.672	0.649	0.683	0.824	0.756	**0.838**

Note: Diagonal elements (bold) represent square roots of AVE; off-diagonal elements represent construct correlation.

Table 7 applies the Fornell-Larcker criterion to assess the discriminant validity of constructs. The diagonal values in the table, represented by bold symbols, indicate the square root of the Average Variance Extracted (AVE) for each construct. The off-diagonal values represent the correlations among various constructs. Discriminant validity is confirmed only if the square root of the AVE for each construct exceeds its correlations with other constructs. From the table, it can be observed that the square root of the AVE for Business Performance (0.838) is higher than its correlations with other constructs, such as Competitiveness (0.824) and Human Resource Capabilities (0.687). Similarly, the AVE for Human Resource Capabilities at 0.798 is higher than its correlations with Product Innovation (0.724), Process Innovation (0.758**), and others. All Heterotrait-Monotrait Ratio (HTMT) values remain below the conservative threshold of 0.85, with most below 0.80.

Table 8. Construct a correlation matrix – HTMT criterion.

Construct	HRC	PI	PROI	TI	OI	SI	COMP	MS	BP
HRC	1.000	0.783	0.817	0.823	0.805	0.802	0.592	0.558	0.734
PI	0.783	1.000	0.756	0.770	0.751	0.768	0.579	0.551	0.714
PROI	0.817	0.756	1.000	0.804	0.786	0.791	0.627	0.581	0.756
TI	0.823	0.770	0.804	1.000	0.803	0.816	0.621	0.574	0.755
OI	0.805	0.751	0.786	0.803	1.000	0.834	0.472	0.558	0.744
SI	0.802	0.768	0.791	0.816	0.834	1.000	0.689	0.617	0.770
COMP	0.592	0.579	0.627	0.621	0.472	0.689	1.000	0.763	0.884
MS	0.558	0.551	0.581	0.574	0.558	0.617	0.763	1.000	0.818
BP	0.734	0.714	0.756	0.755	0.744	0.770	0.884	0.818	1.000

Table 8 presents the construct correlation matrix based on the Heterotrait-Monotrait (HTMT) ratio of correlations, which is a more rigorous criterion for assessing discriminant validity. According to the HTMT guideline, discriminant validity is considered acceptable when all HTMT values are below the conservative threshold of 0.85 or the more lenient threshold of 0.90, depending on the research context.

The highest HTMT value (0.884 between COMP and BP) slightly exceeds 0.85 but remains below 0.90, which is acceptable for theoretically related constructs. On the other hand, cross-loading analysis confirmed that each indicator loaded highest on its intended construct. The mean difference between primary loadings and highest cross-loadings was 0.186 (range: 0.087-0.394), providing additional evidence for discriminant validity. While some correlations between theoretically related constructs (e.g., competitiveness and business performance) were moderately high, all three discriminant validity tests were satisfied, confirming that constructs are empirically distinct despite their theoretical relationships.

4.2. Descriptive Statistics and Correlations

4.2.1. Sample Characteristics

The final sample of 249 Batik SME owners demonstrated good representativeness of the East Java batik industry.

Table 9. Demographic profile.

Category	Subgroup	Percentage (%)	Frequency (n)
Gender	Female	53.8	134
	Male	46.2	115
Age	Under 30 years	20.1	50
	31–40 years	51.0	127
	41–50 years	20.9	52
	51–60 years	8.0	20

Table 9 outlines the demographic profile of the respondents participating in the study. In terms of gender, 53.8% of respondents are female (n = 134), while 46.2% are male (n = 115), indicating a slightly higher female representation among Batik SME owners. Regarding age distribution, the majority of respondents fall within the 31–40 years age group, accounting for 51.0% (n = 127). This is followed by those aged 41–50 years (20.9%, n = 52) and under 30 years (20.1%, n = 50). A smaller proportion of participants is aged 51–60 years, comprising 8.0% (n = 20) of the sample.

Table 10 describes the business characteristics of the Batik SMEs surveyed. The majority of the businesses are of limited size, with 34.1% having 4-6 employees (85), followed by 30.9% with 1-3 employees (77). Additionally, 23.3% of the businesses have 7-10 employees (58), and only 11.6% have more than 10 employees (29). Regarding business age, nearly half of the SMEs (49.0%, n = 122) have been operating for 7–10 years, followed by 28.9% (n = 72) that have existed for 2–6 years. Older enterprises, operating for more than 10 years, account for 22.1% (n = 55) of the

sample. Concerning ownership structure, the majority of the businesses are independently owned (63.1%, n = 157), while 24.1% are family-owned (n = 60), and 12.8% (n = 32) operate under collaborative partnerships.

Table 10. Business characteristics.

Category	Subgroup	Percentage (%)	Frequency (n)
Employee size	1–3 employees	30.9	77
	4–6 employees	34.1	85
	7–10 employees	23.3	58
	More than 10 employees	11.6	29
Business age	2–6 years	28.9	72
	7–10 years	49.0	122
	Over 10 years	22.1	55
Ownership structure	Independent	63.1	157
	Family Business	24.1	60
	Collaborative Partnership	12.8	32

Table 11. Construct descriptive statistics.

Construct	Mean	SD	Min	Max	Skewness	Kurtosis
Human resource capabilities	3.89	0.52	2.47	4.93	-0.18	0.42
Product innovation	3.76	0.58	2.20	4.90	-0.25	0.38
Process innovation	3.82	0.55	2.31	4.85	-0.22	0.45
Technological innovation	3.71	0.61	2.15	4.88	-0.19	0.33
Organizational innovation	3.68	0.59	2.25	4.75	-0.16	0.29
Service innovation	3.74	0.56	2.40	4.80	-0.21	0.41
Competitiveness	3.95	0.61	2.33	5.00	-0.31	0.52
Marketing strategy	3.77	0.64	2.17	4.92	-0.23	0.36
Business performance	3.91	0.58	2.45	4.95	-0.28	0.47

Table 11 reports the descriptive statistics for each construct, including mean, standard deviation (SD), minimum and maximum values, skewness, and kurtosis. These statistics provide an overview of the central tendency and distributional characteristics of the data used in the analysis. The mean scores for all constructs range between 3.68 and 3.95 on a 5-point Likert scale, indicating generally high agreement levels among respondents. Competitiveness has the highest mean (3.95), followed closely by Business Performance (3.91) and Human Resource Capabilities (3.89), suggesting that respondents perceive their firms as relatively competitive and performing well, with strong human capital. Standard deviations range from 0.52 to 0.64, indicating moderate variability in responses across constructs. The minimum and maximum values show the full range of scale utilization, with all constructs covering at least part of the full 1–5 Likert scale. Skewness values are slightly negative for all constructs (ranging from -0.16 to -0.31), indicating mild left-skewed distributions. However, the values are close to zero, suggesting approximate symmetry. Kurtosis values are all positive but below 1 (ranging from 0.29 to 0.52), indicating light-tailed distributions, which do not significantly deviate from normality.

4.2.2. Construct Descriptive Statistics

All the constructs exhibited around normal distributions for PLS-SEM analysis. The skewness values ranged from -0.16 to -0.31, showing slight negative skew but within the acceptable range (±2.0). The kurtosis values ranged from 0.29 to 0.52, indicating distributions close to normal. The mean scores were concentrated around 3.7-3.9 on the 5-point scale, reflecting medium to higher levels for all the constructs.

Table 12. Summary of correlation matrix findings.

Aspect	Details
Strongest correlations	• Competitiveness ↔ Business performance (r = 0.824, $p < 0.001$) • Human Resource Capabilities ↔ Process innovation (r = 0.758, $p < 0.001$) • Human resource capabilities ↔ Product innovation (r = 0.724, $p < 0.001$)
Weakest correlations	• Organizational Innovation ↔ Competitiveness (r = 0.389, $p < 0.001$) • Marketing Strategy ↔ Human Resource Capabilities (r = 0.512, $p < 0.001$)
Overall patterns	• Mean correlation magnitude: $r = 0.632$ • Range: 0.389 to 0.824 • All correlations significant at $p < 0.001$ • Innovation dimensions intercorrelated strongly ($r = 0.634$ to 0.694), supporting theoretical structure

The correlation matrix in Table 12 showed statistically significant and theoretically plausible correlations between the constructs. The highest correlations were found between Competitiveness and Business Performance (r = 0.824), and between Human Resource Capabilities and Process Innovation (r = 0.758) and Product Innovation (r = 0.724). In contrast, the lowest correlations were established between Organizational Innovation and Competitiveness (r = 0.389) and Marketing Strategy and Human Resource Capabilities (r = 0.512). The average correlation size, overall, came to r = 0.632, with all correlations significant at p < 0.001. Innovation constructs, importantly, showed strong intercorrelations (r = 0.634 to 0.694), confirming their conceptual relationship as related but separate dimensions.

Table 13. Structural model fit and diagnostic summary.

Category	Indicator	Value / Range	Interpretation
Primary fit indices	SRMR	0.061	Good fit (Well below 0.08 threshold)
	NFI	0.847	Acceptable fit (>0.80), approaching good fit benchmark (>0.90)
	RMS Theta	0.094	Acceptable specification (<0.12 threshold)
Exact fit assessment	d_ULS	1.847 (95% CI: 0.923–2.456)	Non-significant; supports model adequacy
	d_G	0.798 (95% CI: 0.421–1.089)	Non-significant; supports exact model fit
Multicollinearity (VIF)	VIF Range	1.234 – 4.687	No multicollinearity concerns (<5.0 threshold)
	Mean VIF	2.891	Within an acceptable range
	VIF > 3.0	4 of 24 paths (16.7%)	Limited occurrence; not problematic

Table 13 presents the structural model fit and diagnostic summary, offering evidence of the model's overall adequacy and statistical robustness. Several key indices are reported to evaluate model fit, exact specification, and multicollinearity. Collectively, these diagnostic indicators confirm that the structural model is well-specified, free from multicollinearity issues, and statistically valid for hypothesis testing and interpretation.

4.3. Structural Model Assessment

4.3.1. Goodness of Fit Evaluation

The structural model provided a good overall fit, underpinned by some *important key state* indices. The Standardized Root Mean Square Residual (SRMR) amounted to 0.061, below the 0.08 recommended threshold, indicating very slight differences between observed and anticipated correlations. The Normed Fit Index (NFI) was 0.847, above the 0.80 criterion for adequate fit and nearing the 0.90 threshold for good fit. The RMS Theta was 0.094, below the 0.12 criterion, further confirming appropriate model specification. Additionally, bootstrap-based exact model fit tests (d_ULS = 1.847; d_G = 0.798) did not confirm the model as adequate, but they support the theoretical possibility of it. These exuberantly large explanatory powers imply the model is successful in explaining the performance results of Batik SMEs. Nevertheless, the R^2 values, particularly 97.2% for business performance, are abnormally large, with potential overfitting concerns. However, it is eliminated through a good theoretical foundation, prediction power (Q^2), and weak multicollinearity (VIF), signifying structural validity and stability of the

model in this classical industry scenario. Multicollinearity diagnostics further reinforced the model's reliability. Variance Inflation Factor (VIF) values ranged from 1.234 to 4.687, with a mean of 2.891, all well below the standard threshold of 5.0. The structural relations exceeded only 16.7% of these connections, with a mean of 3.0, showing that multicollinearity did not pose a serious problem. These findings jointly validate the structural model's robustness, theoretical integration, and statistical validity.

4.3.2. Hypothesis Testing Results

The model demonstrated exceptional explanatory power across all endogenous constructs.

Table 14. Endogenous construct.

Endogenous construct	R^2	R^2 adjusted	Cohen's classification
Product innovation	0.524	0.522	Large
Process innovation	0.575	0.573	Large
Technological innovation	0.536	0.534	Large
Organizational innovation	0.464	0.462	Large
Service innovation	0.494	0.492	Large
Competitiveness	0.919	0.917	Large
Business performance	0.972	0.971	Large

Table 14 presents that these results indicate that human resource capabilities explain 46.4% to 57.5% of the variance in innovation dimensions, while the full model explains 91.9% of competitiveness variance and an exceptional 97.2% of business performance variance. Human resource capabilities, which have been linked by all hypotheses to various dimensions of innovation, received strong support.

Table 15. Linking human resource capabilities to innovation dimensions.

Hypothesis	Path	β	SE	t-value	p-value	95% CI	f^2	Decision
H1	HRC → PI	0.724	0.029	24.87	<0.001	[0.668, 0.779]	1.099	Supported
H2	HRC → PROI	0.758	0.025	30.14	<0.001	[0.709, 0.806]	1.353	Supported
H3	HRC → TI	0.732	0.028	26.18	<0.001	[0.677, 0.785]	1.156	Supported
H4	HRC → OI	0.681	0.034	19.87	<0.001	[0.614, 0.747]	0.865	Supported
H5	HRC → SI	0.703	0.031	22.65	<0.001	[0.642, 0.763]	0.976	Supported

Table 15 describes the process; innovation showed the strongest relationship with human resource capabilities ($\beta = 0.758$). All the effect sizes (f^2) were large (>0.35), signifying considerable practical significance. Confidence intervals for all paths excluded zero, verifying statistical relevance. The pattern holds that human capabilities are most influential in the case of process and technological innovations.

4.3.2.1. Innovation Dimensions on Competitiveness

The relationships between innovation dimensions and competitiveness showed varied patterns.

Table 16. Innovation dimensions on competitiveness.

Hypothesis	Path	β	SE	t-value	p-value	95% CI	f^2	Decision
H6	PI → COMP	0.122	0.047	2.59	0.010	[0.030, 0.214]	0.018	Supported
H7	PROI → COMP	0.197	0.066	2.98	0.003	[0.067, 0.327]	0.041	Supported
H8	TI → COMP	0.168	0.069	2.43	0.015	[0.032, 0.304]	0.031	Supported
H9	OI → COMP	0.064	0.091	0.70	0.484	[-0.115, 0.243]	0.004	Not supported
H10	SI → COMP	0.464	0.089	5.21	<0.001	[0.289, 0.639]	0.183	Supported

Table 16 shows that service innovation was the most powerful predictor of competitiveness (β = 0.464, f^2 = 0.183). Organizational innovation was not significantly related to competitiveness. Process innovation had a moderate effect (β = 0.197) with practical value. Product and technology innovations had smaller significant effects.

4.3.2.2. Direct Effects on Business Performance

Both competitiveness and innovation dimensions showed significant direct effects on business performance:

Table 17. Competitiveness and innovation on business performance.

Hypothesis	Path	β	SE	t-value	p-value	95% CI	f^2	Decision
H11	COMP → BP	0.570	0.067	8.49	<0.001	[0.438, 0.702]	0.298	Supported
H12	PI → BP	0.152	0.046	3.31	0.001	[0.062, 0.242]	0.025	Supported
H13	PROI → BP	0.259	0.063	4.11	<0.001	[0.135, 0.383]	0.068	Supported
H14	TI → BP	0.117	0.059	1.98	0.048	[0.001, 0.233]	0.014	Supported
H15	OI → BP	0.465	0.084	5.54	<0.001	[0.300, 0.630]	0.147	Supported
H16	SI → BP	0.162	0.055	2.95	0.003	[0.054, 0.270]	0.027	Supported

Table 17 reports that the analysis revealed that competitiveness exerted a strong mediating effect on business performance, with a path coefficient of β = 0.570 and a medium-to-large effect size (f^2 = 0.298). Organizational innovation showed the highest among the innovation constructs and the strongest direct effect on performance, with a path coefficient of β = 0.465 and an attached effect size of f^2 = 0.147, signifying a substantial contribution.

Notably, all innovation areas continued to exhibit statistically significant direct impacts on performance while controlling for the mediator role of competitiveness. This means that innovation's impact on performance acts both through direct (unmediated) and indirect (mediated) channels, reflecting the various angles through which innovation exerts its positive influence on business outcomes.

4.3.2.3. Moderation Effects of Marketing Strategy

The marketing strategy showed complex and nuanced moderating effects. Table 18 summarizes the moderation effects of marketing strategy on the relationship between various innovation constructs and business performance. Each hypothesis (H17 to H22) tests whether the marketing strategy (MS) significantly influences the strength or direction of the relationship between innovation and performance outcomes.

Table 18. The moderating effects of marketing strategy.

Hypothesis	Path	β	SE	t-value	p-value	95% CI	f^2	Decision
H17	PI × MS → BP	-0.088	0.043	2.04	0.044	[-0.172, -0.003]	0.008	Supported (Negative)
H18	PROI × MS → BP	-0.098	0.044	2.23	0.027	[-0.184, -0.011]	0.010	Supported (Negative)
H19	TI × MS → BP	0.019	0.039	0.49	0.629	[-0.058, 0.096]	0.000	Not Supported
H20	OI × MS → BP	0.253	0.062	4.08	<0.001	[0.131, 0.375]	0.082	Supported (Positive)
H21	SI × MS → BP	-0.107	0.044	2.43	0.016	[-0.193, -0.020]	0.012	Supported (Negative)
H22	COMP × MS → BP	0.089	0.051	1.74	0.082	[-0.011, 0.189]	0.008	Not Supported

Negative moderated the effects of product, process, and service innovation by marketing strategy. Organizational innovation exhibited a positive moderation by marketing strategy, while technological innovation and competitiveness exhibited no significant moderation effects. These trends imply that marketing concentration can

divert innovation activity's resource bases. Overall, these findings imply that the influence of marketing strategy as a moderator is innovation-type dependent, enhancing certain innovation outcomes (organizational) while diluting others (product, process, service). This challenges the assumption that marketing strategies universally amplify innovation impacts.

4.3.2.4. Predictive Relevance Assessment

Stone-Geisser Q^2 values confirmed strong predictive relevance across all endogenous constructs.

Table 19. Stone-Geisser Q^2.

Construct	Q^2	Predictive power
Product innovation	0.321	Medium
Process innovation	0.362	Medium
Technological innovation	0.334	Medium
Organizational innovation	0.254	Medium
Service innovation	0.291	Medium
Competitiveness	0.621	Large
Business performance	0.681	Large

Table 19 reports the Stone-Geisser Q^2 values, which assess the model's predictive relevance using a blindfolding procedure. Q^2 values greater than zero indicate that the model has predictive capability, and the magnitude of Q^2 helps classify the strength of that prediction: values around 0.25 indicate medium predictive power, while values above 0.50 suggest large predictive power. These results reinforce the model's robustness and its practical usefulness in predicting both innovation strategies and performance outcomes within Batik SMEs.

4.3.2.5. Moderation Effects of Marketing Strategy

The marketing strategy showed complex and nuanced moderating effects.

Table 20. Marketing strategy on business performance.

Hypothesis	Path	β	SE	t-value	p-value	95% CI	f^2	Decision
H17	PI × MS → BP	-0.088	0.043	2.04	0.044	[-0.172, -0.003]	0.008	Supported (Negative)
H18	PROI × MS → BP	-0.098	0.044	2.23	0.027	[-0.184, -0.011]	0.010	Supported (Negative)
H19	TI × MS → BP	0.019	0.039	0.49	0.629	[-0.058, 0.096]	0.000	Not supported
H20	OI × MS → BP	0.253	0.062	4.08	<0.001	[0.131, 0.375]	0.082	Supported (Positive)
H21	SI × MS → BP	-0.107	0.044	2.43	0.016	[-0.193, -0.020]	0.012	Supported (Negative)
H22	COMP × MS → BP	0.089	0.051	1.74	0.082	[-0.011, 0.189]	0.008	Not supported

Table 20 evaluates the moderating role of marketing strategy on the relationship between various strategic drivers and business performance, focusing on innovation and competitiveness. Each hypothesis (H17–H22) tests whether marketing strategy (MS) alters the effect of different constructs, Product Innovation (PI), Process Innovation (PROI), Technological Innovation (TI), Organizational Innovation (OI), Service Innovation (SI), and Competitiveness (COMP) on Business Performance (BP).

Negative moderation of marketing strategy was exhibited by product, process, and service innovation impacts. Organizational innovation was the only innovation that positively moderated marketing strategy. The marketing

strategy was not significantly shown to exhibit a moderating influence. These tendencies imply that marketing stress can distract innovation activity's resources.

5. CONCLUSION

This research offers exhaustive proof of the indispensable role of human resource capabilities as determinants of innovation strategy in conventional SMEs, specifically in the case of Indonesian batik businesses. By employing rigorous empirical examination of 249 East Java batik SME proprietors, we demonstrated that human capabilities such as overall technical expertise, creativity, flexibility, knowledge diffusion capabilities, and problem-solving ability serve as primary motivators for innovation. Our findings indicate that innovation within craft sectors is multidimensional, with various types of innovation following divergent paths toward business success. Service innovation appears to be the most critical for competitive positioning, while organizational innovation has the most significant direct relationships with secondary performance outcomes. These insights challenge simplistic innovation models and provide practical guidance for traditional SME management.

Above all else, the findings of the study are in favor of sustainability-led innovation. Here, we show how people-oriented capabilities can enable environmentally conscious operation, maintain intangible cultural heritage, and provide inclusive employment in order to position human resource development as not just a performance enhancer but as the chief sustainability driver of environment, economy, and society in the classical industries. The most is in reference to policymakers and development institutions that would like to guarantee that SME development is in tandem with sustainable development goals (SDGs).

The study also identifies nuanced marketing strategy-innovation outcome relationships, indicating that marketing activity needs to be genuinely matched with certain types of innovation in order to deliver maximum impact. Instead of being universally effective, marketing strategy both positively and negatively moderates the relationship, given the innovation dimension, emphasizing the imperative for strategic marketing-innovation integration. Theoretically, the study broadens the Resource-Based View, Dynamic Capabilities, and innovation frameworks to conventional industries, providing an illustration of how conventional models play out differently in labor-intensive, culturally ingrained business settings. The study adds to the expanding literature on innovation in new economies as well as conventional industries, sectors that, by and large, in conventional innovation studies, have come under scrutiny.

In practice, our findings provide straightforward advice for various stakeholder groups. SME proprietors can prioritize balanced innovation portfolios and human resource development while carefully aligning marketing strategies with innovation efforts. Policymakers can design assistance programs that consider the human-centered nature of innovation in traditional industries. Industry bodies can facilitate member organizations in sharing knowledge and building capabilities.

As the world's traditional craft sectors face rising challenges emanating from the process of globalization, digital disruption, and climate change, innovation as an empowerment of human potential for sustainable innovation is not only a matter of strategy but also of culture and the environment. This research confirms that traditional wisdom, when innovatively empowered, can become a great engine for the production of distinctive, sustainable, and world-relevant value in local economies.

The future of traditional SMEs does not reside in the loss of their cultural heritage in the pursuit of generic modernization, but in the strategic utilization of their distinct human endowments in the innovation of products that span tradition and the latest market needs. This innovation human-centered strategy presents a sustainable framework for traditional sectors aiming to retain their cherished way of life, yet reach business mileage in the competitive world market.

Future studies can persist in investigating the intricate dynamics of tradition and innovation, investigating how traditional systems of knowledge can guide innovation practices in the present day, not only in emerging economies

but in various industrial and cultural settings. As the world economy places a heightened value on authenticity, heritage, and sustainability, traditional SMEs that can successfully assimilate their human potential with strategic innovation can very much hold the future of culturally ingrained economic development.

6. IMPLICATION

6.1. Theoretical Implications

The research provides various novel theoretical contributions to innovation in conventional SMEs and the innovation Propel function of human resource capabilities.

6.1.1. Extension of Resource-Based View to Traditional SMEs

The result significantly confirms the Resource-Based View thesis that human resource capabilities are essential VRIN (valuable, rare, inimitable, non-substitutable) assets in conventional craft sectors. The close connections among human capabilities and all innovation areas ($\beta = 0.681$ to 0.758) illustrate that in creative labour-intensive sectors, human assets are the main innovation platform instead of technological or capital assets. The extension of the RBV theory is made by indicating how conventional knowledge, artwork ability, and adaptability capabilities develop distinctive innovation potential that is radically distinct from resource superiority in technology-driven sectors.

6.1.2. Innovation Dimensionality in Traditional Industries

The findings show that innovation is not an undifferentiated construct in conventional SMEs, as various types of innovation exhibit varying antecedents and consequences. The result that innovation service has the greatest impact on competitiveness ($\beta = 0.464$), while organizational innovation has the most direct influence on performance ($\beta = 0.465$), indicates that conventional craft sectors exhibit distinctive innovation dynamics. This refutes all-encompassing innovation theories and confirms the rationale for the context-specific study of the innovation process.

The particular interest of finding is that organizational innovation has no material impact upon competitiveness ($\beta = 0.064$, $p = 0.484$) while having a robust direct impact upon performance. This indicates that organizational advances in the inward-facing mode can build operational effectiveness and profitability in ways that lack explicit distinguishability in the market, offering a new theoretical finding concerning the double conduits by which innovation impacts business performance.

6.1.3. Human Capabilities as Dynamic Capabilities

The study corroborates and enriches the Dynamic Capabilities theory by illustrating how human resource capabilities facilitate sensing, seizing, and reconfiguring at conventional SMEs. The stable, robust correlations among human capabilities and innovation areas confirm that in conventional sectors, dynamic capabilities reside mainly in people, not organizational routines or technological systems. This constitutes a significant extension of dynamic capabilities theory to resource-limited, traditional industry settings.

6.1.4. Complex Marketing-Innovation Interactions

The mixed moderating forces of marketing strategy uncover a newly discovered intricacy in innovation-performance dynamics. Although marketing positively enhances organizational innovation effects ($\beta = 0.253$), marketing opposes the effects of product, process, and service innovation. The results show that marketing strategy is not positively generic in innovation outcomes, as often overestimated in innovation-marketing literature. Rather, marketing strategy needs to be meticulously matched with certain innovation types in order to circumvent resource rivalry and strategic incompatibility.

6.2. Practical Implications

The pervasive impact of human resource capabilities on all dimensions of innovation provides useful strategic advice for policymakers and SME managers. For SME proprietors of batik, it serves as a reminder of the imperatives to prioritize Whole-person Human Resource Development programs that integrate the learning of traditional craftsmanship with the attainment of contemporary business capabilities.

Main proposals are the introduction of skills formation programs that combine traditional techniques of batik making with current design, manufacturing, and business knowledge. Furthermore, knowledge diffusion mechanisms like apprenticeships that match senior artisans with greenhorns can conserve the heritage while creating innovation. Lastly, adaptive capacity development by means of recurrent learning shall increase workers' learning mobility and technology adaptability in order that innovation shall prosper while the authenticity of the craftsmanship of the batik shall not be compromised.

6.3. Policy and Industry Support Implications

The research provides some significant guideposts for future SME development policies aimed at revitalizing traditional SMEs. In the first place, investment in human capital should take precedence over capital-intensive interventions.

Development institutions and government agencies must focus their efforts on reinforcing human resource development, recognizing that in traditional sectors such as batik, innovation capacity resides in people, not solely in technology.

Second, innovation support systems should capture the multidimensionality of innovation. Rather than providing blanket innovation programs, policies must offer specialized assistance that is geared to individual innovation types like product, process, or organizational innovation in a way that supports is appropriate to the variety of needs among SMEs.

Third, industry network formation needs to be fostered because sharing of knowledge and social learning are essential in preserving innovation. Policymakers must foster the creation and deepening of industry networks and associations that enable cooperation and exchange among producers of batik.

7. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

There were a number of limitations in this study that suggest fruitful areas for future research. The first limitation was the cross-sectional nature of the data, which prevents us from seeing how relationships change over time. Longitudinal studies investigating the development and influence of innovation strategies over longer time spans, especially in the face of changing market conditions, can benefit future scholarship. Furthermore, although in the current study the case concerned East Java's SMEs that produce batik, the results can't entirely apply to other regions producing batik or traditional arts.

Broadening the research scope to account for various geographical and cultural settings would help to give it broader applicability. Another limitation of the study is the measurement of human capabilities. Even though their value is emphasized, future research needs to create more detailed and nuanced metrics that can reflect the distinctive skills, areas of knowledge, and capabilities at play in traditional crafts. Furthermore, given that the SMEs that produce batik are going digital more and more, future research needs to explore how human capabilities can spur digital transformation as an outcome.

The current study mainly presents the supply side perspective, emphasizing the SME owners. The inclusion of consumer perspectives in future studies would help to provide a much broader picture of how innovation of various kinds is perceived and valued in the traditional craft market.

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