

Digital Ecosystem Integration, Innovation Capability, and Global Market Performance of MSMEs: The Role of Institutional Support

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Abstract

This study examines how Digital Ecosystem Integration, Market Intelligence Capability, Innovation Capability, and Institutional Support shape the Global Market Performance of Micro, Small, and Medium Enterprises (MSMEs) in Indonesia. Using Banyumas Regency as the empirical setting, the study proposes an integrated capability-based framework linking digital ecosystem engagement and market intelligence with global performance through Innovation Capability, while incorporating Institutional Support as a moderating condition. Data were collected through a cross-sectional survey of 100 digitally engaged MSMEs and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings show that Digital Ecosystem Integration positively affects Innovation Capability ($\beta = 0.669$; $p < 0.001$) and Global Market Performance ($\beta = 0.326$; $p < 0.001$). Market Intelligence Capability also positively influences Innovation Capability ($\beta = 0.345$; $p < 0.001$) and Global Market Performance ($\beta = 0.517$; $p < 0.001$). Innovation Capability mediates the effects of Digital Ecosystem Integration ($\beta = 0.148$; $p = 0.002$) and Market Intelligence Capability ($\beta = 0.076$; $p = 0.014$) on Global Market Performance. Institutional Support further strengthens the relationship between Innovation Capability and Global Market Performance ($\beta = 0.184$; $p = 0.001$). The model explains 84.3% of the variance in Global Market Performance and 68.3% in Innovation Capability, with Q^2 values of 0.741 and 0.584, respectively. The study extends the Dynamic Capability perspective by identifying digital ecosystem integration as a strategic capability, innovation capability as a transformation mechanism, and institutional support as a boundary condition. These findings offer practical guidance for strengthening MSME digital ecosystems and sustainable global competitiveness.

Keywords: Digital Ecosystem Integration, Market Intelligence Capability, Innovation Capability, Institutional Support, Global Market Performance, MSMEs.

1. Introduction

The rapid expansion of the digital economy has significantly reshaped the competitive landscape of micro, small, and medium enterprises (MSMEs), particularly in emerging economies where digital technologies create new opportunities for market expansion and value creation. In Indonesia, the increasing adoption of online marketplaces, digital payment systems, and digital logistics has enabled many MSMEs to expand beyond local markets, supported by government initiatives promoting digital transformation and export readiness. By 2024, approximately 27 million MSMEs had adopted digital technologies, with the government targeting 30 million digitally connected MSMEs. However, MSMEs contributed only around 15.7% of Indonesia's total exports, indicating that the rapid growth of digital adoption has not yet been matched by comparable improvements in global market competitiveness. This discrepancy suggests that digital participation alone is insufficient to ensure successful internationalization and highlights the need to understand how strategic organizational capabilities transform digital ecosystem participation into superior global market performance [1].

Banyumas Regency provides a strategically relevant empirical setting for this study due to its expanding economic capacity and increasing engagement in international trade. According to Badan Pusat Statistik Kabupaten Banyumas (BPS Banyumas), the regency recorded a Gross Regional Domestic Product (GRDP) of IDR 74.16 trillion in 2024, while export activities grew by 6.36% compared with the previous year. Export performance was primarily supported

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by essential oils, processed wood, and crystal coconut sugar, demonstrating the presence of regionally competitive industries with established international market linkages [2]. Despite these favorable economic conditions, empirical evidence explaining how digitally connected MSMEs translate participation in digital ecosystems into sustained global market performance remains limited. This gap highlights the importance of examining the organizational capabilities that enable MSMEs to convert digital integration into superior international market outcomes.

This phenomenon indicates that digital adoption alone may not be sufficient to generate superior performance outcomes. While digital technologies enhance operational efficiency and market accessibility, many MSMEs face challenges in transforming digital engagement into strategic advantages such as innovation, differentiation, and international market penetration. Recent studies suggest that the effectiveness of digital transformation depends on firms' ability to integrate digital resources, develop market intelligence, and build dynamic capabilities that support value creation in increasingly competitive environments [3], [4], [5]. Consequently, understanding how MSMEs convert digital ecosystem participation into measurable global performance outcomes has become an important research issue.

From a theoretical perspective, existing research on MSMEs' digitalization has predominantly focused on technology adoption, digital readiness, or platform utilization as key determinants of firm performance. Although these perspectives provide valuable insights, they often conceptualize digitalization as a technological input rather than as a strategic integration process embedded within interconnected digital ecosystems. Innovation capability, which plays a crucial role in enabling firms to respond to market changes and develop competitive advantages, has not been sufficiently examined as a transformation mechanism linking digital ecosystem integration and market intelligence capability to global market performance [6], [3]. This limitation highlights the need for more integrative approaches that capture the dynamic relationships among strategic capabilities and performance outcomes.

Another important factor influencing MSMEs' competitiveness is institutional support. Policy facilitation, access to financing, digital training programs, and export promotion initiatives can significantly enhance firms' ability to commercialize innovation and scale their operations internationally. Institutional economics literature emphasizes that supportive environments reduce uncertainty and transaction costs while strengthening firms' capacity to exploit market opportunities [7], [8]. However, empirical studies have largely treated institutional support as either a direct determinant of performance or a contextual variable, with limited attention given to its contingent role in strengthening the effectiveness of innovation capability.

Despite the growing body of research on MSMEs' digital transformation, several important gaps remain. Prior studies have mainly examined digital adoption and platform usage, while limited attention has been given to digital ecosystem integration as a strategic construct reflecting firms' embeddedness within interconnected technological and market networks [9], [10]. Furthermore, the mechanisms through which firms transform digital engagement and market intelligence into innovation capability and subsequently into global market performance remain insufficiently explored [11], [12]. Empirical research also rarely conceptualizes institutional support as having a dual role both as a direct performance driver and as a moderating factor that conditions capability effectiveness [13]. These gaps are particularly relevant in emerging economy contexts where MSMEs face structural constraints in achieving sustained global competitiveness.

Building upon these identified research gaps, this study advances the existing literature in three important ways. First, most studies emphasize digital adoption, platform utilization, or technological readiness while giving limited attention to digital ecosystem integration as a higher order strategic capability that enables firms to orchestrate inter organizational relationships and leverage ecosystem resources. Second, previous research has generally examined innovation capability or market intelligence capability in isolation, providing limited evidence of how these complementary capabilities jointly contribute to sustained global market performance. Third, institutional support has predominantly been treated as a direct antecedent of firm performance rather than as a contextual mechanism that strengthens the effectiveness of internally developed capabilities. Addressing these limitations, this study proposes an integrated capability-based framework in which digital ecosystem integration and market intelligence capability enhance global market performance through innovation capability, while conceptualizing institutional support as a

strategic boundary condition that reinforces the effectiveness of innovation capability in improving global market performance.

Based on these considerations, this study addresses the following research questions: (1) To what extent does digital ecosystem integration influence the global market performance of MSMEs? (2) Does innovation capability mediate the relationships between digital ecosystem integration, market intelligence capability, and global market performance? (3) How does institutional support directly and contingently affect the effectiveness of innovation capability in enhancing global market performance? This study contributes to the literature by shifting the focus from digital adoption to digital ecosystem integration, positioning innovation capability as a key transformation mechanism, and examining the dual role of institutional support within an integrated capability ecosystem framework. Empirically, the study provides evidence from MSMEs in an emerging economy setting, offering practical insights for policymakers and practitioners in strengthening digital ecosystem development and innovation support programs to enhance MSMEs' global competitiveness.

2. Literature Review

Digital ecosystem integration refers to the extent to which firms are strategically embedded within interconnected digital platforms, infrastructures, and collaborative networks that enable resource sharing, information exchange, and value co creation across organizational boundaries [14]. Unlike basic digital adoption, ecosystem integration emphasizes firms' capability to orchestrate digital relationships with multiple stakeholders such as customers, suppliers, logistics providers, and platform intermediaries to enhance strategic responsiveness and scalability [15]. Empirical studies indicate that participation in digital ecosystems strengthens firms' dynamic capabilities by improving access to complementary assets and reducing coordination costs in networked markets [16]. Furthermore, deeper ecosystem embeddedness has been associated with improved SME competitiveness and international market participation as firms leverage digital infrastructures to overcome geographic and institutional barriers [17].

Although Digital Ecosystem Integration and Market Intelligence Capability are both associated with firms' digital transformation, they represent conceptually distinct strategic capabilities. Digital Ecosystem Integration emphasizes the firm's capability to establish, coordinate, and leverage relationships within interconnected digital platforms and business networks to access complementary resources and create collaborative value. In contrast, Market Intelligence Capability focuses on the firm's ability to systematically sense, interpret, and utilize market information to support strategic decision making and opportunity recognition. Therefore, while Digital Ecosystem Integration primarily reflects relational and network orchestration capabilities, Market Intelligence Capability represents an analytical and knowledge-based capability that enables firms to respond effectively to changing market conditions. Their complementary roles provide the theoretical foundation for examining how external digital connectedness and internal market sensing jointly contribute to innovation capability and global market performance.

Market intelligence capability is defined as a firm's ability to systematically acquire, analyze, and utilize market related information to support strategic decision making and opportunity recognition in dynamic competitive environments [6], [3]. From a dynamic capability perspective, market intelligence functions as a sensing mechanism that enables firms to anticipate customer needs, monitor competitor behavior, and respond effectively to market turbulence [15]. Prior research suggests that firms with strong intelligence capabilities are better positioned to exploit digital platform opportunities and adjust their value propositions to meet evolving global demand patterns [18]. In digital contexts, the use of analytics and data driven insights further enhances firms' strategic flexibility and performance outcomes by facilitating informed market entry and positioning decisions [11].

Innovation capability refers to a firm's capacity to transform knowledge resources, technological inputs, and market insights into new or improved products, processes, and business models that generate sustainable competitive advantage [19]. Within digital transformation literature, innovation capability is conceptualized as a transformation mechanism through which firms recombine digital assets and strategic intelligence to create value enhancing outcomes and adaptive strategies [20]. Empirical evidence indicates that innovation capability improves productivity, differentiation, and responsiveness to market heterogeneity, thereby supporting firms' expansion into international

markets [15]. Moreover, firms embedded in digital ecosystems tend to demonstrate higher levels of innovation performance due to enhanced collaboration, knowledge spillovers, and access to external expertise [21].

Institutional support encompasses policy facilitation, financial assistance, digital capability development programs, and regulatory frameworks that shape firms' strategic behavior and performance outcomes [22]. Institutional economics literature suggests that supportive institutional environments reduce uncertainty, enhance legitimacy, and enable firms to exploit market opportunities more effectively [20]. Recent studies highlight that government led digital transformation initiatives and export promotion policies play a crucial role in strengthening MSMEs' competitiveness by improving access to digital infrastructure and innovation resources [19]. Beyond its direct influence on firm performance, institutional support may also condition the effectiveness of internal capabilities by providing incentives, infrastructure, and market access mechanisms necessary for innovation commercialization and global scaling [15].

Global market performance represents the extent to which firms achieve favorable outcomes in international markets, including export growth, market diversification, and sustained competitive positioning [20]. Unlike global market access, which reflects entry into foreign markets, global performance emphasizes the effectiveness and sustainability of firms' international operations over time [11]. Empirical research demonstrates that global performance is influenced by firms' strategic capabilities, innovation outcomes, and ecosystem participation that enable scalability and long term competitiveness [18]. For MSMEs, achieving strong global market performance requires the integration of digital ecosystem embeddedness, market intelligence utilization, and institutional support mechanisms that facilitate adaptive learning and value creation across diverse market contexts [21].

2.1. Digital Ecosystem Integration and Innovation Capability

Digital ecosystem integration enables firms to leverage interconnected platforms, collaborative networks, and shared digital infrastructures that facilitate knowledge recombination and innovation development. Recent studies indicate that firms embedded in digital ecosystems demonstrate stronger innovation performance due to enhanced access to complementary resources and real time market feedback mechanisms [23], [12]. Research in SME digital transformation also highlights that ecosystem participation improves innovation agility and supports co creation processes that accelerate product and process innovation [24]. Furthermore, digital network embeddedness strengthens firms' absorptive capacity and technological alignment, enabling more effective innovation capability building [25]. Evidence from emerging digital markets suggests that ecosystem integration enhances firms' experimentation capacity and strategic renewal, which are critical drivers of innovation outcomes [21]. Collectively, the existing literature suggests that digital ecosystem integration facilitates innovation capability through stronger inter organizational collaboration and digital resource orchestration [15], [26]. However, emerging evidence suggests that the innovation benefits derived from ecosystem participation are contingent upon firms' internal capabilities, organizational readiness, and ecosystem characteristics, indicating that ecosystem integration alone does not necessarily guarantee superior innovation outcomes [27]. These mixed findings indicate that the relationship between digital ecosystem integration and innovation capability remains contingent upon organizational and contextual conditions, particularly among MSMEs operating in emerging economies. Accordingly, the following hypothesis is proposed:

H1: Digital ecosystem integration positively influences innovation capability

2.2. Market Intelligence Capability and Innovation Capability

Market intelligence capability supports innovation capability by enabling firms to interpret market signals, anticipate customer needs, and align innovation initiatives with evolving demand conditions. Recent empirical research demonstrates that firms with advanced market sensing capabilities exhibit higher innovation responsiveness and adaptability in dynamic environments [28], [29]. Studies on data driven decision making further indicate that the use of analytics and customer insight systems enhances innovation effectiveness by improving strategic learning processes [30], [31]. Additionally, firms utilizing digital intelligence tools are more capable of identifying niche opportunities and accelerating innovation cycles [32]. Evidence from SME research confirms that intelligence driven firms achieve stronger innovation outcomes due to improved alignment between internal capabilities and external market requirements [33]. Collectively, the existing literature suggests that market intelligence capability enhances innovation capability by enabling firms to recognize emerging market opportunities, integrate customer knowledge, and support evidence-based innovation decisions [28], [29]. However, emerging evidence indicates that the effectiveness of market

intelligence capability depends on firms' analytical competencies, organizational learning capacity, and their ability to transform market intelligence into actionable innovation strategies. Consequently, the availability of market information alone does not necessarily lead to superior innovation capability unless it is effectively embedded within organizational decision-making processes and capability development. These mixed findings indicate that the relationship between market intelligence capability and innovation capability remains contingent upon organizational capabilities and contextual conditions, particularly among MSMEs operating in emerging economies. Accordingly, the following hypothesis is proposed:

H2: Market intelligence capability positively influences innovation capability

2.3. Innovation Capability and Global Market Performance

Innovation capability plays a crucial role in enhancing firms' global market performance by supporting differentiation, scalability, and strategic flexibility in international operations. Recent studies show that innovation-oriented SMEs demonstrate stronger export growth and international competitiveness due to their ability to exploit technological opportunities and respond to heterogeneous market demands [19]. Research on global value chain participation further highlights that innovation capability improves firms' performance by enabling adaptive business models and process optimization [34]. Empirical evidence also suggests that innovation capability contributes to sustained performance outcomes through improved productivity and value creation mechanisms [24]. Moreover, innovative firms embedded in digital ecosystems tend to achieve superior global positioning due to enhanced collaboration and knowledge integration [21]. Collectively, the existing literature consistently suggests that innovation capability serves as a strategic mechanism through which firms transform technological resources, market knowledge, and organizational learning into superior global market performance. By continuously developing innovative products, processes, and business models, firms are better positioned to strengthen international competitiveness and respond effectively to dynamic global market conditions [19], [34], [35]. Accordingly, the following hypothesis is proposed:

H3: Innovation capability positively influences global market performance

2.4. Digital Ecosystem Integration and Global Market Performance

Digital ecosystem integration can directly improve firms' global market performance by facilitating cross border transactions, expanding market reach, and enabling firms to leverage platform-based network effects. Recent research indicates that SMEs participating in digital ecosystems experience improved international visibility and performance due to reduced coordination costs and enhanced access to global customers [28], [29]. Studies on platform enabled internationalization further demonstrate that ecosystem participation strengthens firms' competitiveness through technological alignment and interfirm collaboration [15]. Additionally, digital ecosystem embeddedness supports scalability by enabling firms to utilize shared logistics and payment infrastructures [36], [37]. Evidence from digital entrepreneurship research also shows that ecosystem integration enhances firms' performance by improving market penetration and operational efficiency [32]. Collectively, the existing literature consistently suggests that digital ecosystem integration enhances global market performance by enabling firms to access wider international markets, strengthen inter organizational collaboration, and improve operational efficiency through digitally connected business ecosystems. These capabilities allow firms to respond more effectively to global market opportunities while reducing coordination barriers associated with cross border business activities [15], [36], [37]. Accordingly, the following hypothesis is proposed:

H4: Digital ecosystem integration positively influences global market performance

2.5. Market Intelligence Capability and Global Market Performance

Market intelligence capability contributes directly to global market performance by enhancing firms' ability to identify international opportunities, refine market entry strategies, and manage competitive uncertainty. Recent studies demonstrate that intelligence driven firms achieve higher export performance due to improved strategic targeting and responsiveness to environmental changes [29]. Research in international entrepreneurship also shows that data driven market sensing strengthens firms' global competitiveness by facilitating adaptive learning and opportunity exploitation [38]. Furthermore, firms utilizing advanced analytics capabilities are better able to sustain performance outcomes in volatile global markets [28], [29]. Evidence from SME digitalization studies confirms that market intelligence

capability improves performance sustainability by aligning innovation outputs with global demand trends [33]. Collectively, the existing literature consistently suggests that market intelligence capability enhances global market performance by enabling firms to identify international market opportunities, anticipate customer needs, and formulate more effective competitive strategies. Through systematic market sensing and evidence-based decision making, firms are better positioned to improve international responsiveness, strengthen strategic adaptability, and sustain superior performance in dynamic global markets [28], [29], [38]. Accordingly, the following hypothesis is proposed:

H5: Market intelligence capability positively influences global market performance

2.6. The Mediating Role of Innovation Capability

Innovation capability functions as a transformation mechanism that converts digital ecosystem participation and market intelligence into global market performance outcomes. Dynamic capability research suggests that strategic resources and sensing capabilities must be recombined into innovative outputs before performance benefits can be realized [38], [39]. Recent empirical studies indicate that innovation capability mediates the impact of digital transformation initiatives on firm performance by enhancing differentiation and scalability [40]. Research also highlights that innovation driven value creation strengthens the performance effects of ecosystem participation and intelligence utilization [24]. Furthermore, firms that effectively transform digital engagement into innovation activities demonstrate stronger international performance due to improved adaptability and competitiveness [35]. Collectively, the existing literature suggests that innovation capability serves as a critical transformation mechanism through which firms convert digital resources, ecosystem participation, and market intelligence into sustainable global market performance. Rather than influencing performance directly, digital ecosystem integration and market intelligence capability provide firms with access to strategic knowledge, collaborative resources, and market insights that must first be transformed into innovative products, services, and business processes before generating competitive advantages in international markets. This capability-based transformation process explains why innovation capability is expected to mediate the relationships between digital ecosystem integration, market intelligence capability, and global market performance. Accordingly, the following hypotheses are proposed:

H6: Innovation capability mediates the relationship between digital ecosystem integration and global market performance

H7: Innovation capability mediates the relationship between market intelligence capability and global market performance

2.7. The Moderating Role of Institutional Support

Institutional support is expected to strengthen the relationship between innovation capability and global market performance by providing policy facilitation, financial incentives, and capability development programs that enhance firms' ability to commercialize innovation in international markets. Recent studies show that government led digital transformation initiatives and export promotion policies significantly improve SMEs' ability to translate innovation into performance gains [41]. Institutional economics research also suggests that supportive regulatory environments reduce uncertainty and enable firms to exploit global market opportunities more effectively [22]. Empirical evidence indicates that firms operating within strong institutional ecosystems demonstrate more effective innovation performance linkages due to improved access to infrastructure and market facilitation mechanisms [36], [37]. Moreover, institutional support enhances firms' legitimacy and scalability in international markets, thereby strengthening performance sustainability [28], [29], [13]. Collectively, the existing literature suggests that institutional support functions as a strategic boundary condition that strengthens the effectiveness of innovation capability in improving global market performance. Firms possessing strong innovation capability are more likely to achieve superior international performance when supported by favorable institutional environments that provide policy incentives, financial assistance, digital infrastructure, and export facilitation. Conversely, in the absence of adequate institutional support, firms may encounter barriers that limit the commercialization of innovation and reduce the performance benefits derived from their innovative capabilities. Accordingly, institutional support is expected to strengthen the positive relationship between innovation capability and global market performance. Therefore, the following hypothesis is proposed:

H8: Institutional support positively moderates the relationship between innovation capability and global market performance

The relationships among digital ecosystem integration, market intelligence capability, innovation capability, institutional support, and global market performance, as represented by Hypotheses H1–H8, are summarized in the proposed research framework shown in [figure 1](#).

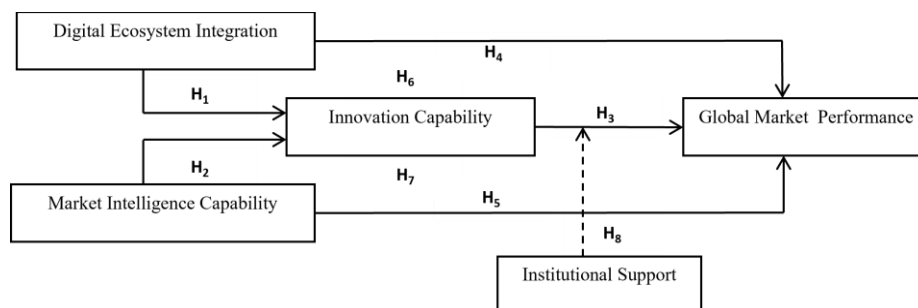


Figure 1. Research framework

3. Methodology

3.1. Research Design

This study employed a quantitative, cross sectional research design to examine the relationships among digital ecosystem integration, market intelligence capability, innovation capability, institutional support, and global market performance of MSMEs. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used as the primary analytical technique because of its suitability for testing complex models involving direct, mediating, and moderating relationships, as well as its ability to provide robust predictions in studies with relatively small sample sizes and latent constructs measured by multiple indicators [42]. Given the cross-sectional nature of the research design, the findings should be interpreted as associative rather than causal relationships. Although the proposed framework is theoretically grounded in Dynamic Capability Theory, longitudinal research is recommended to capture the temporal evolution of organizational capabilities and to provide stronger evidence regarding causal mechanisms.

3.2. Population and Sampling Procedure

The target population comprised digitally active MSMEs located in Banyumas Regency, Indonesia. Respondents were selected purposively to capture enterprises with direct involvement in digital business practices. Eligibility was determined using three criteria: MSMEs had to (1) use at least one digital business facility, including e commerce, social commerce, or digital payment services; (2) have a minimum operating history of two years; and (3) reach customers outside their immediate local market. Before the main questionnaire was administered, preliminary screening questions were used to confirm these requirements. Responses from enterprises failing to meet any of the criteria were omitted, thereby maintaining consistency between the final sample and the study context. Sample adequacy was established through an a priori power calculation in G*Power 3.1 for the endogenous construct with the largest number of predictors [43]. The calculation specified $f^2 = 0.15$, $\alpha = 0.05$, power = 0.80, and five predictors, yielding a minimum requirement of 92 cases. The 100 usable responses obtained in this study therefore surpassed this requirement and were also consistent with the PLS-SEM sample size guidance provided by Hair et al. [42].

3.3. Data Collection

The survey was administered from January to March 2026 through a combination of digital and face to face distribution. Digital responses were obtained through communication platforms and MSME networks, whereas direct distribution took place during business development and networking activities. Eligibility was verified before respondents proceeded to the main questionnaire based on the predetermined sampling requirements. Responses to all construct items were recorded on a five-point Likert scale anchored from 1 (strongly disagree) to 5 (strongly agree). Before full scale data collection, the instrument was pretested with a small number of MSME owners to assess item clarity and suitability for the study context.

3.4. Measurement of Constructs

Construct measures were drawn from previously validated instruments and contextually adjusted for digitally oriented MSMEs without altering their underlying conceptual domains. Five reflective items were assigned to each latent variable. Digital Ecosystem Integration captured firms' involvement in digital platforms, network embeddedness, and cross organizational digital connections through which ecosystem resources can be coordinated and utilized [16], [37], [26]. Market Intelligence Capability reflected the capacity to gather market information, interpret customer and competitor signals, and apply such knowledge to strategic choices and opportunity identification [28], [29]. Innovation Capability captured firms' ability to develop new offerings, refine business processes, and adapt business models in response to market change [40], [35], [44]. Institutional Support represented perceived access to policy assistance, capability building initiatives, and financial support relevant to MSME digitalization and competitiveness [20], [22]. Global Market Performance captured expansion beyond immediate local markets through regional, national, and international engagement, including external market sales growth, customer expansion, competitive position, and the increasing share of sales generated outside the local market. This specification accommodates the gradual internationalization trajectory commonly observed among Indonesian MSMEs [11], [5].

3.5. Data Analysis Method

Data analysis was performed with SmartPLS 4 using Partial Least Squares Structural Equation Modeling (PLS-SEM). This approach was selected because the study examines multiple simultaneous relationships involving direct, indirect, and interaction effects while emphasizing both explanation and prediction. Model assessment proceeded in two stages. First, the measurement model was examined through indicator loadings, internal consistency reliability, convergent validity, and discriminant validity. Reliability was evaluated using Cronbach's alpha and composite reliability, whereas convergent validity was assessed through Average Variance Extracted (AVE). Discriminant validity was examined using the Heterotrait-Monotrait (HTMT) criterion [42]. Second, the structural model was assessed using collinearity statistics, coefficients of determination (R^2), effect sizes (f^2), predictive relevance (Q^2), and the magnitude and significance of the estimated paths. Indirect effects were examined to determine the mediating function of Innovation Capability, while the interaction between Institutional Support and Innovation Capability was estimated to evaluate moderation. Statistical inference was obtained through bootstrapping with 5,000 resamples, using a 5% significance level [42], [47]. Predictive performance beyond in sample explanatory power was additionally examined with PLSpredict by comparing PLS-SEM prediction errors against those generated by a linear benchmark model [47].

3.6. Common Method Bias Assessment

Because all constructs were measured through a single self reported questionnaire, common method bias (CMB) was addressed using both procedural and statistical measures. Procedurally, respondent anonymity and confidentiality were maintained, the questionnaire was refined through pilot testing, and construct measures were adapted from previously validated instruments, consistent with recommended practices for limiting method related bias in behavioral research [45]. Statistically, CMB was examined through the full collinearity VIF approach. All resulting VIF values remained below the recommended threshold of 3.3 [46], suggesting that common method bias was unlikely to materially affect the validity of the empirical results.

4. Results and Discussion

4.1. Outer Loadings

The evaluation of the measurement model began with an assessment of indicator reliability using outer loadings. Outer loading values above 0.70 indicate that the observed variables adequately represent their corresponding latent constructs [42]. Table 1 presents the outer loading results for all measurement items included in this study.

Table 1. Outer Loadings of Measurement Items

Construct	Indicators	Outer Loading
Digital Ecosystem Integration (DEI)	DEI1	0.853
	DEI2	0.853
	DEI3	0.860

	DEI4	0.827
	DEI5	0.855
Global Market Performance (GMP)	GMP1	0.846
	GMP2	0.820
	GMP3	0.834
	GMP4	0.860
	GMP5	0.834
Innovation Capability (IC)	IC1	0.818
	IC2	0.839
	IC3	0.836
	IC4	0.823
	IC5	0.813
Institutional Support (IS)	IS1	0.731
	IS2	0.828
	IS3	0.829
	IS4	0.819
	IS5	0.797
Market Intelligence Capability (MIC)	MIC1	0.808
	MIC2	0.857
	MIC3	0.837
	MIC4	0.850
	MIC5	0.846
Institutional Support × Innovation Capability	IS × IC	1.000

The results presented in [table 1](#) indicate that all measurement items exceeded the recommended threshold of 0.70, demonstrating satisfactory indicator reliability and convergent validity [41]. Outer loading values ranged from 0.731 to 0.860, confirming that each item provided an adequate representation of its intended latent construct. The measurement items associated with Digital Ecosystem Integration (DEI), Global Market Performance (GMP), Innovation Capability (IC), and Market Intelligence Capability (MIC) consistently exhibited high loading values, supporting the reliability of the measurement model.

Among the latent constructs, Digital Ecosystem Integration exhibited the highest loading value (DEI3 = 0.860), whereas Institutional Support recorded the lowest loading value (IS1 = 0.731). Despite this variation, all loading values remained above the recommended cut off threshold and were therefore retained for subsequent analysis. Furthermore, the interaction construct representing Institutional Support × Innovation Capability (IS × IC) produced a loading value of 1.000, which is expected because the moderation effect was specified as a single latent interaction construct. Overall, these findings provide strong evidence of satisfactory indicator reliability and support the adequacy of the measurement model for subsequent assessments of construct reliability, validity, and structural relationships.

4.2. Measurement Model Evaluation

The measurement model was evaluated by examining indicator reliability, internal consistency reliability, convergent validity, and discriminant validity, following recent PLS-SEM reporting guidelines [42], [47]. First, indicator reliability was assessed using outer loadings. All indicators exceeded the recommended threshold of 0.70, with values ranging from 0.731 to 0.860, indicating that all observed variables adequately represented their respective latent constructs.

Second, internal consistency reliability was assessed through Cronbach's alpha and composite reliability (CR). As presented in [table 2](#), Cronbach's alpha values ranged from 0.761 to 0.873, while CR values ranged from 0.800 to 0.879, both exceeding the minimum recommended threshold of 0.70 [42]. These results confirm satisfactory construct reliability.

Third, convergent validity was examined using the average variance extracted (AVE). All AVE values were above the cut off value of 0.50, ranging from 0.643 to 0.801, indicating that each construct explained more than 50% of the variance of its indicators. Finally, discriminant validity was assessed using the heterotrait–monotrait ratio (HTMT). All HTMT values were below the conservative threshold of 0.85 suggested by recent methodological studies [47]. The highest HTMT value was observed between innovation capability and global market performance (0.816), which remained within the acceptable range. Therefore, discriminant validity was established.

Table 2. Measurement Model Evaluation

Construct	Loading Range	Cronbach's α	CR	AVE	Maximum HTMT
Digital Ecosystem Integration	0.827-0.860	0.873	0.879	0.801	0.788
Global Market Performance	0.820-0.860	0.866	0.874	0.782	0.816
Innovation Capability	0.813-0.839	0.858	0.868	0.757	0.816
Institutional Support	0.731-0.829	0.761	0.800	0.643	0.261
Market Intelligence Capability	0.808-0.857	0.867	0.874	0.783	0.788

4.3. Assessment of the Structural Model

After establishing the adequacy of the measurement model, the structural relationships were examined using collinearity statistics, explained variance (R^2), predictive relevance (Q^2), effect sizes (f^2), and bootstrap inference, consistent with current PLS-SEM recommendations [42], [47]. Predictor VIFs varied between 1.077 and 3.597, all below the critical value of 5.0 [42], suggesting that collinearity did not materially affect the estimated relationships. The model accounted for 84.3% of the variance in Global Market Performance ($R^2 = 0.843$) and 68.3% in Innovation Capability ($R^2 = 0.683$), indicating considerable explanatory strength for both endogenous constructs.

Predictive relevance was also supported. The Stone Geisser Q^2 statistics reached 0.741 for Global Market Performance and 0.584 for Innovation Capability, substantially exceeding zero [42], [47]. Regarding effect magnitude, Digital Ecosystem Integration showed its largest contribution to Innovation Capability ($f^2 = 1.336$) and a moderate contribution to Global Market Performance ($f^2 = 0.267$). Market Intelligence Capability produced substantial effects on Global Market Performance ($f^2 = 1.212$) and Innovation Capability ($f^2 = 0.355$). Smaller but meaningful contributions to Global Market Performance were observed for Innovation Capability ($f^2 = 0.092$), Institutional Support ($f^2 = 0.197$), and the Institutional Support $\times$ Innovation Capability interaction ($f^2 = 0.104$). Bootstrap estimates reported in table 3 support all eight hypotheses.

Table 3. Structural Model and Hypothesis Testing

Hypothesis	Path	Original Sample	T statistics	P values	Result
H1	Digital Ecosystem Integration $\rightarrow$ Innovation Capability	0.669	13.024	0.000	Supported
H2	Market Intelligence Capability $\rightarrow$ Innovation Capability	0.345	5.420	0.000	Supported
H3	Innovation Capability $\rightarrow$ Global Market Performance	0.221	3.042	0.002	Supported
H4	Digital Ecosystem Integration $\rightarrow$ Global Market Performance	0.326	4.980	0.000	Supported
H5	Market Intelligence Capability $\rightarrow$ Global Market Performance	0.517	9.067	0.000	Supported
H6	Digital Ecosystem Integration $\rightarrow$ Innovation Capability $\rightarrow$ Global Market Performance	0.148	3.074	0.002	Supported
H7	Market Intelligence Capability $\rightarrow$ Innovation Capability $\rightarrow$ Global Market Performance	0.076	2.468	0.014	Supported
H8	Institutional Support $\times$ Innovation Capability $\rightarrow$ Global Market Performance	0.184	3.293	0.001	Supported

Digital Ecosystem Integration significantly predicts Innovation Capability ($\beta = 0.669$, $p < 0.001$) and Global Market Performance ($\beta = 0.326$, $p < 0.001$), whereas Market Intelligence Capability significantly predicts Innovation Capability ($\beta = 0.345$, $p < 0.001$) and Global Market Performance ($\beta = 0.517$, $p < 0.001$). Innovation Capability also contributes positively to Global Market Performance ($\beta = 0.221$, $p = 0.002$). The indirect effects further establish the mediating function of Innovation Capability. Significant mediation occurs between Digital Ecosystem Integration and Global Market Performance ($\beta = 0.148$, $p = 0.002$) and between Market Intelligence Capability and Global Market Performance ($\beta = 0.076$, $p = 0.014$). Thus, innovation provides an important pathway through which ecosystem connectivity and market intelligence are converted into performance

outcomes. Institutional Support also strengthens the Innovation Capability Global Market Performance relationship ($\beta = 0.184$, $p = 0.001$), supporting H8. This interaction indicates that innovation generates greater performance benefits when firms operate within more supportive institutional conditions. The complete structural estimates are visualized in [figure 2](#).

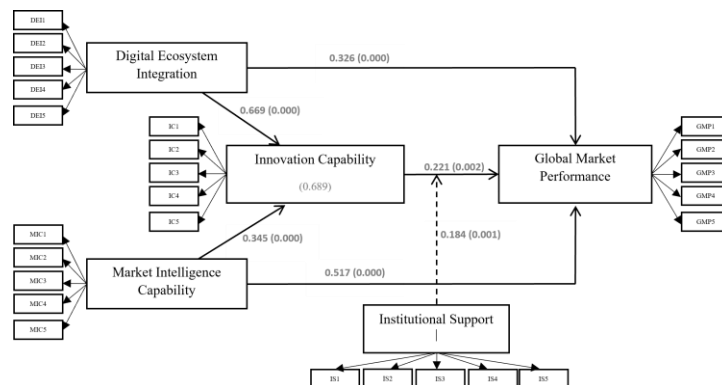


Figure 2. Structural model results

To facilitate interpretation of the moderation effect, [figure 3](#) illustrates the interaction between Institutional Support and Innovation Capability in predicting Global Market Performance. The positive effect of Innovation Capability becomes stronger as Institutional Support increases from low (-1 SD) to high ($+1$ SD), whereas lower Institutional Support produces smaller performance gains. These findings confirm that Institutional Support strengthens the contribution of Innovation Capability to Global Market Performance, providing additional support for Hypothesis 8.

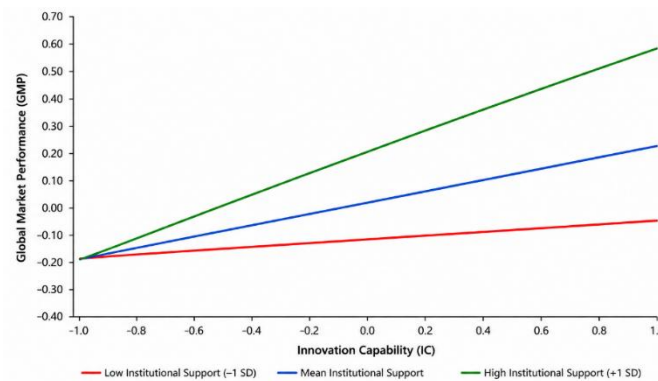


Figure 3. Moderating effect of institutional support

Predictive performance was further examined using PLSpredict in accordance with recent PLS-SEM recommendations [42], [47]. Q^2 predict ranged from 0.551 to 0.783 across the endogenous indicators, with every value above zero. Moreover, PLS-SEM generated lower RMSE values than the linear model for 8 of the 10 indicators. Taken together, these results indicate medium to high out of sample predictive performance and complement the model's high explanatory power. They also reduce concerns that the observed R^2 values primarily reflect overfitting, construct overlap, or common method bias.

The path estimates also reveal distinct predictor priorities. Market Intelligence Capability has the largest direct association with Global Market Performance ($\beta = 0.517$), followed by Digital Ecosystem Integration ($\beta = 0.326$) and Innovation Capability ($\beta = 0.221$). For Innovation Capability, however, Digital Ecosystem Integration is the dominant predictor ($\beta = 0.669$), compared with Market Intelligence Capability ($\beta = 0.345$). Thus, market intelligence appears more immediately relevant to broader market performance, whereas ecosystem integration plays a stronger role in building innovation capacity. Managerially, this pattern favors strengthening market intelligence for near term market expansion while developing ecosystem integration to support longer term innovation and competitiveness.

4.4. Discussion

The results reinforce the Dynamic Capability perspective by showing that MSMEs derive global market benefits not simply from adopting digital technologies, but from combining ecosystem connectivity, market sensing, and innovation-oriented resource transformation. Digital Ecosystem Integration is positively associated with both

Innovation Capability and Global Market Performance, suggesting that connections with digital platforms, logistics networks, and payment infrastructures provide MSMEs with complementary resources, learning opportunities, and market knowledge. This pattern is consistent with prior evidence linking ecosystem embeddedness with organizational adaptability and resource orchestration [16], [15], [37]. The present study, however, moves beyond viewing digital participation as technology use by treating Digital Ecosystem Integration as a higher order capability through which firms coordinate external relationships and mobilize ecosystem resources. Market Intelligence Capability also contributes significantly to Innovation Capability and Global Market Performance, underscoring the value of interpreting customer preferences, competitive movements, and emerging opportunities. This result supports earlier evidence on the role of intelligence-based decision making in responsiveness and international competitiveness [6], [29], [11], while showing that market intelligence complements ecosystem integration in supporting wider market engagement.

The relative magnitude of the estimated relationships offers an additional theoretical insight. Market Intelligence Capability has a stronger direct association with Global Market Performance ($\beta = 0.517$) than Digital Ecosystem Integration ($\beta = 0.326$) or Innovation Capability ($\beta = 0.221$). This difference suggests that timely market knowledge can translate more immediately into market decisions, such as identifying demand shifts, selecting promising segments, and adjusting competitive responses. Innovation Capability, by contrast, involves a transformation process in which knowledge and resources must first be converted into products, processes, or business model changes before performance benefits materialize. Digital Ecosystem Integration plays a particularly important role in this process, as its relationship with Innovation Capability ($\beta = 0.669$) is substantially stronger than that of Market Intelligence Capability ($\beta = 0.345$). Thus, ecosystem integration appears especially important for building innovation capacity, whereas market intelligence provides a more immediate pathway to broader market performance.

The mediation findings further clarify how these capabilities work together. Innovation Capability carries significant indirect effects from both Digital Ecosystem Integration and Market Intelligence Capability to Global Market Performance, indicating that access to ecosystem resources and market knowledge becomes more valuable when firms can convert these inputs into new offerings, improved processes, and adaptable business models. This mechanism is consistent with the Dynamic Capability view that competitive outcomes depend on the reconfiguration of internal and external resources in response to environmental change [38], [35], [40]. Rather than treating digitalization as a direct route to performance, the findings identify innovation as an intermediate organizational process through which digitally acquired resources and market knowledge contribute to broader market outcomes.

Institutional Support adds an important contextual dimension to this capability process. Its positive interaction with Innovation Capability indicates that innovation produces stronger performance benefits when MSMEs have greater access to policy facilitation, capability development initiatives, digital training, financial assistance, and market support. This result accords with previous evidence that supportive institutional arrangements can reduce uncertainty and facilitate innovation commercialization [22], [13], [41]. More importantly, Institutional Support operates here not merely as an external resource but as a boundary condition that increases the performance value of internally developed Innovation Capability. The interaction plot in [figure 3](#) reinforces this interpretation by showing a steeper Innovation Capability Global Market Performance relationship at higher levels of Institutional Support.

Taken together, the findings extend research on digital transformation and Dynamic Capability by showing that MSME competitiveness reflects a coordinated capability system rather than isolated digital adoption. Digital Ecosystem Integration provides access to interconnected resources, Market Intelligence Capability enables firms to interpret market signals, Innovation Capability converts these inputs into commercially relevant changes, and Institutional Support strengthens the performance returns from that transformation. For managers, this implies that digital investment should be accompanied by stronger market sensing and innovation processes. For policymakers, programs aimed at MSME digitalization are likely to generate greater value when technology access is combined with capability development, commercialization support, and mechanisms that facilitate broader market participation.

5. Conclusion

This study shows that MSMEs achieve stronger Global Market Performance when digital ecosystem connectivity and market intelligence are effectively translated into Innovation Capability. Both Digital Ecosystem Integration and Market Intelligence Capability are associated with performance directly and through Innovation Capability, indicating that access to digital networks and market knowledge becomes more valuable when firms can convert these resources into innovative business outcomes. Institutional Support further amplifies the performance contribution of Innovation Capability, demonstrating that internal capabilities generate greater value under supportive institutional conditions.

The study extends the Dynamic Capability perspective through an integrated framework that connects ecosystem orchestration, market sensing, innovation transformation, and institutional reinforcement. Rather than treating digitalization primarily as technology adoption, the findings show how interconnected organizational capabilities work together in explaining MSMEs' broader market performance. This framework also identifies Institutional Support as an important boundary condition that complements internally developed capabilities.

Practically, the findings suggest that strengthening MSME competitiveness requires more than expanding access to digital technologies. Firms should develop market sensing and innovation capabilities alongside deeper participation in digital ecosystems, while policymakers should complement digitalization initiatives with training, financing, commercialization assistance, and broader market access support. Nevertheless, the cross-sectional design does not establish temporal ordering, and reliance on self-reported responses may introduce perceptual bias. The purposive sample drawn from Banyumas Regency also limits broader generalization. Future research could therefore employ longitudinal and multi-region designs, incorporate objective behavioral and performance measures, and examine additional capabilities such as digital leadership, absorptive capacity, and international network orientation.

6. Declarations

6.1. Author Contributions

Conceptualization: Y.N., A.A.K., H.H., D.I.S.S., M.I.R., and L.N.H.; Methodology: A.A.K.; Software: Y.N.; Validation: Y.N., M.I.R., and L.N.H.; Formal Analysis: Y.N., M.I.R., and L.N.H.; Investigation: Y.N.; Resources: M.I.R.; Data Curation: M.I.R.; Writing Original Draft Preparation: Y.N., M.I.R., and L.N.H.; Writing Review and Editing: M.I.R., Y.N., and L.N.H.; Visualization: Y.N.; All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.3. Funding

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6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

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

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