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# FROM DIGITAL READINESS TO BUSINESS RESILIENCE: THE MEDIATING ROLE OF SUPPLY CHAIN INTEGRATION IN THE ADOPTION OF BIG DATA ANALYTICS AMONG TOURISM SME'S

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**Abstract**

The tourism industry in East Java faces complex challenges in managing the supply chain, particularly in integrating data and coordinating among business actors. This study explores how supply chain digitalization based on Big Data Analytics (BDA) can be key to strengthening business resilience. Using a quantitative approach and Partial Least Squares–Structural Equation Modeling (PLS-SEM) analysis, data were collected from 185 business operators across various subsectors, including accommodation, transportation, restaurants, and tourist destinations. The findings indicate that digital readiness significantly drives the adoption of BDA, which in turn strengthens supply chain integration and enhances business resilience. The role of supply chain integration as a partial mediator underscores the importance of data coordination in amplifying BDA's impact. The proposed BDA-based Digital TSC model was shown to enhance organizational efficiency, synergy, and resilience, expanding the application of Dynamic Capabilities Theory in the context of tourism in developing countries, while providing strategic insights for stakeholders and policymakers.

**Keywords: Adoption, Big Data Analytics, Digitalization, Business Resilience, Tourism Supply Chain**

## INTRODUCTION

The tourism industry plays a strategic role in Indonesia's national economy, serving as a foreign exchange earner, job creator, and driver of regional development. Within the framework of the Sustainable Development Goals (SDGs), this sector's contribution is specifically recognized in Goal 8 regarding decent work and sustainable economic growth (Bappenas, 2025). The Central Statistics Agency (2024) reports that the number of domestic tourist trips reached 850.80 million in 2023, up from 734.86 million the previous year—a surge reflecting the momentum of the national tourism recovery following the COVID-19 pandemic.

Behind this impressive growth, the management of the Tourism Supply Chain (TSC) remains a challenge that has not yet been fully resolved. Zhang et al. (2009) define the TSC as a coordinated network of organizations, resources, and processes that connects producers to end tourists. This network involves diverse actors, ranging from accommodation providers and transportation operators to destination managers and travel agencies, operating within a configuration of high cross-dependency and sensitivity to demand fluctuations. Under such conditions, a disruption at a single point in the supply chain has the potential to ripple through the entire ecosystem disproportionately, as illustrated by the bullwhip effect (Lee et al., 1997; Buhalis & Law, 2008).

This challenge is exacerbated by the low level of digital integration among Indonesian tourism businesses, particularly Micro, Small, and Medium Enterprises (MSMEs), which still dominate the

industry structure. Perelygina et al. (2022) identified digital fragmentation as a structural barrier that creates information gaps, operational inefficiencies, and a low capacity to respond to changes in demand. Furthermore, this fragmentation weakens the collective resilience of the tourism system in the face of external shocks such as pandemics, natural disasters, or drastic changes in tourist preferences.

Big Data Analytics (BDA) offers a transformative solution to this problem. Its ability to integrate cross-actor data in real-time, identify demand patterns, and support evidence-based decision-making makes it a potential enabler for TSC integration and resilience (Centobelli & Ndou, 2019; Gupta et al., 2020). Several studies have demonstrated the effectiveness of BDA in improving supply chain performance in the manufacturing (Tiwari, 2021) and retail (Agrawal &Narain, 2018) sectors; however, its application in the context of tourism supply chains, particularly in developing countries, remains empirically limited (Luu et al., 2025).

East Java was selected as the research location because it combines two analytically relevant characteristics: the diversity and vitality of its tourism sector, on the one hand, and a significant gap in the digital readiness of its business actors, on the other. This combination creates an ideal context for testing how BDA-based supply chain digitalization can drive business resilience, particularly in situations where many MSMEs are still in the early stages of digital transformation.

By identifying the empirical gap acknowledged by Lu et al. (2025) and Hofmann et al. (2019), this study makes three main contributions: (1) empirically testing the mechanism of how digital readiness influences BDA adoption and tourism business resilience; (2) developing a BDA-based Digital TSC model that is adaptable to the characteristics of Indonesian tourism; and (3)formulating evidence-based policy recommendations for stakeholders in the national tourism ecosystem.

## LITERATURE REVIEW AND HYPOTHESIS FORMULATION

### *Tourism Supply Chain and Its Characteristics*

*The Tourism Supply Chain* is a management concept referring to an integrated network of all actors and processes involved in the creation, distribution, and consumption of tourism products. Zhang et al. (2009) identified four main components of the TSC: procurement of raw materials and services, production of tourism services, distribution to tourists, and consumption at the destination. Unlike conventional supply chains, the TSC possesses unique characteristics that fundamentally distinguish it: its core product is *intangible*, production and consumption are inseparable, the product is perishable and cannot be stored, and its service composition is highly heterogeneous.

Teo et al. (2021) identified three dimensions of coordination that determine TSC effectiveness: information coordination, operational coordination, and relational coordination. Of these three dimensions, accurate and timely information flow is the most critical foundation, as its failure can trigger a *bullwhip* effect—amplifying demand distortions that propagate upstream in the supply chain and result in resource waste (Lee et al.,1997).In the context of TSC, this amplification can simultaneously cause excess accommodation capacity on the one hand and a scarcity of transportation services on the other—a condition that can only be addressed through systematic information integration.

Tourism supply chain resilience—the system's ability to anticipate, adapt to, and recover from disruptions—is increasingly relevant amid rising global uncertainty. Christopher & Peck (2004) define supply chain resilience as the ability to return to the original state or a better state after experiencing a disruption. Ponomarov & Holcomb (2009) emphasize that this resilience is built on three pillars: operational flexibility, resource redundancy, and adaptability—all of which require high-quality information as a prerequisite.

### *Big Data Analytics in Supply Chain Management*

*Big Data Analytics* refers to the process of collecting, processing, and analyzing large-scale, diverse, and fast-moving data to generate actionable insights. Laney (2001) laid the conceptual foundation for BDA through the 3V framework: Volume (enormous data scale), Velocity (processing speed), and Variety (diversity of data types and sources). Gandomi & Haider (2015) subsequently expanded this framework to the 5V model by adding Veracity (data accuracy and reliability) and Value (the business value derived from the analysis).

In the context of supply chain management, BDA serves as an enabler, facilitating end-to-end visibility across the network, more precise demand forecasting, process automation, and faster, more accurate decision-making (Gupta et al., 2020). Tiwari's (2021) systematic review concluded that BDA is the most influential technology in the digital transformation of supply chains in the Industry4.0 era, owing to its ability to integrate data from diverse sources. Centobelli & Ndou (2019) specifically demonstrate that the use of BDA to manage customer knowledge in the tourism sector contributes to improved coordination among service providers as well as operational efficiency.

Jabbour et al. (2020), in their comprehensive review of sustainable digital supply chains, found that digital technologies, including BDA, significantly enhance supply chain transparency and accountability. The relevance of these findings is particularly strong within the sustainable tourism agenda, given the growing pressure from tourists and regulators for socially and environmentally responsible business practices.

***Digital Readiness and Technology Adoption in Tourism***

Digital readiness refers to an organization's capacity to effectively leverage digital technologies in its operations and business strategies. This concept encompasses four interrelated dimensions: technological infrastructure, human resource competencies, a data-oriented organizational culture, and policy and regulatory support (Perelygina et al., 2022). In the tourism sector, digital readiness is a critical determinant of the successful adoption of advanced technological innovations such as BDA. Rogers (2003), in his Theory of Innovation Diffusion, explains that the adoption of new technologies within an organization is influenced by perceptions of relative advantage, compatibility with existing systems, implementation complexity, trialability, and observability of results. Within this framework, digital readiness acts as a moderating factor, mitigating organizational adoption barriers; organizations with high digital readiness tend to adopt BDA more quickly and optimize its benefits (Agrawal & Narain, 2018). A study by Perelygina et al. (2022) on digital business models in the travel industry confirms that the success of digital transformation consistently depends on a previously established foundation of digital readiness, encompassing human resource competencies, IT infrastructure investments and a supported digital partnership ecosystem.

***Collaboration and Integration in the Tourism Supply Chain***

Collaboration among supply chain actors is a key factor in enhancing service performance and the competitiveness of tourism destinations. Brunswicker & Vanhaverbeke (2015) emphasize that in an increasingly complex business environment, the ability to access and integrate external knowledge through open collaboration becomes a source of sustainable competitive advantage. In TSC, this collaboration is concretely realized through information sharing, capacity planning coordination, joint product development, and risk-sharing among business actors—ranging from travel agencies, hotels, and restaurants to transportation providers—to create shared value for tourists (Hu & Tang, 2008; Mesa et al., 2015; Zhang et al., 2010). Well-structured collaboration has also been shown to reduce operational costs, improve efficiency, and strengthen the competitive position of all actors in the supply chain (Chen, 2014; Hu & Tang, 2008).

The effectiveness of this collaboration is further enhanced when supported by technology. Blockchain, IoT, and AI, for example, have been identified as collaboration enablers that improve transparency, data processing efficiency, and coordination among supply chain nodes (Acikgoz &

Stylos, 2023; Benaissa et al., 2013). Kang & Kang (2014) add that the intensity of collaboration is positively correlated with the level of innovation and the quality of services produced, while Wang & Zhang (2025) specifically demonstrate that integrating BDA into supply chain collaboration strategies can accelerate the innovation cycle and improve responsiveness to changes in tourist preferences. In terms of sustainability, deeper supply chain integration—for example, through the principles of the circular economy—enables systemic waste reduction and improved resource efficiency (Aslan, 2026; Bire et al., 2026). Destination Management Organizations (DMOs) play a central role as key integrators that coordinate interactions among stakeholders toward the goal of sustainable tourism (Bire et al., 2026; Karsokiene et al., 2025), while models such as *the Integrated Tourism Service Supply Chain* (ITSSC) offer a structural framework for connecting various service providers within a coordinated system (Hu & Tang, 2008). Nevertheless, significant challenges remain: a lack of coordination, barriers to information flow, and divergent strategies among stakeholders continue to create friction that hinders optimal collaboration (Bai & Chen, 2021; Chen, 2014; Karsokiene et al., 2025). Strategies proven effective in addressing these challenges include the development of data- driven coordination mechanisms (Chen, 2014), the implementation of robust tourism partnership policies (Karsokiene et al., 2025), and the utilization of *Multi-Agent Systems* to support collaborative decision-making (Benaissa et al., 2013). Cross-sector collaboration also opens up broader sustainability opportunities, including the integration of green marketing practices and energy efficiency (Attari & Hanrahan, 2026), as well as triadic collaboration models between airlines, tourist destinations, and travel agencies to optimize the sharing of costs and benefits (Bai & Chen, 2021).

Collectively, the above findings reinforce the role of supply chain integration as a crucial mediating variable in linking BDA analytical capabilities with the overall resilience of the tourism business.

***Conceptual Framework and Research Hypotheses***

This study constructs a conceptual framework that integrates digital readiness, BDA adoption, supply chain integration, and tourism business resilience into a cohesive model. This framework is grounded in two main theories: the Resource-Based View (RBV) proposed by Barney (1991), which states that sustainable competitive advantage stems from resources and capabilities that are valuable, rare, imitable, and non-substitutable (VRIN); and Dynamic Capabilities Theory (Teece et al., 1997), which emphasizes an organization's ability to sense opportunities, seize opportunities, and reconfigure resources in response to environmental changes.

Within this framework, BDA-based analytical capabilities are viewed as strategic resources that enable tourism organizations to perform the three functions of dynamic capabilities simultaneously: detecting changes in tourist demand patterns, optimizing operational responses in *real-time,* and driving adaptive reconfiguration within the TSC network. Based on the theoretical and empirical review above, five research hypotheses are formulated as follows:

***H1: Digital readiness has a positive and significant effect on the adoption of Big Data Analytics among tourism businesses in East Java.***

***H2: The adoption of Big Data Analytics has a positive and significant effect on tourism supply chain integration.***

***H3: Supply chain integration has a positive and significant effect on tourism business resilience.***

***H4: The adoption of Big Data Analytics has a positive and significant effect on tourism business resilience.***

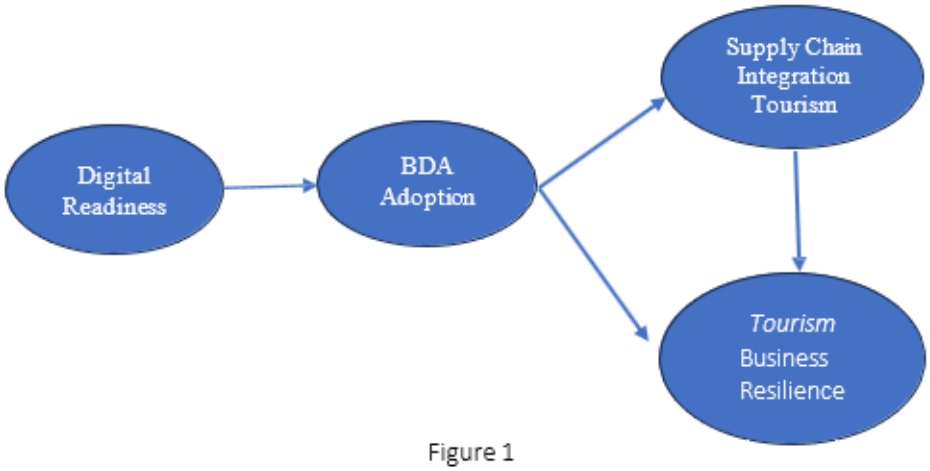



Figure 1
Research Model

## RESEARCH METHODS

### *Research Design and Approach*

This study employs a quantitative approach with a descriptive-explanatory design to elucidate causal relationships among variables based on systematically collected empirical data. The selected analysis method is Partial Least Squares–Structural Equation Modeling (PLS-SEM), a second- generation multivariate statistical technique designed to test models with complex latent variables, formative and reflective indicators, and moderate sample sizes (Hair et al., 2014).

The selection of PLS-SEM was based on three primary methodological considerations. First, PLS- SEM does not require data to be normally distributed, making it more robust for social survey data that often do not meet the normality assumption. Second, this technique is capable of estimating complex models with a relatively smaller sample size compared to Covariance-Based SEM (CB-SEM). Third, PLS-SEM's focus on prediction and variance explanation aligns with this study's objective of developing a generalizable BDA-based Digital TSC model.

### *Population, Sample, and Sampling Technique*

The population of this study consists of all tourism businesses operating in East Java Province that have adopted or are in the process of adopting digital technology in their supply chain operations, including hotels and accommodations, restaurants and culinary businesses, tourism transport operators, tourism destination managers, as well as tour agencies and operators. The sampling technique used is purposive sampling with the following criteria: (1) businesses that have been operating for at least two years; (2) have or are currently implementing a digital system; (3) are located in East Java; and (4) are willing to participate in the study.

The sample size was determined based on the guidelines by Hair et al. (2014) for PLS-SEM, which recommend a minimum of ten times the number of indicators within a single construct. With a construct having a maximum of 5 indicators, the minimum threshold is 50 respondents; however, this study targeted a minimum of 150 respondents to enhance statistical power and representativeness (Hair et al., 2019). A total of 185 respondents were successfully recruited and met the inclusion criteria.

### *Variables and Measurement*

This study involves four main variables, all of which were measured using a 5-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree). Digital readiness was measured using 5 indicators adapted from Perelygina et al. (2022), covering IT infrastructure, HR digital competencies, management support, organizational cultural readiness, and information system integration. BDA adoption was measured through 5 indicators based on the frameworks of Gupta et al. (2020) and Centobelli & Ndou (2019): use of predictive analytics, real-time data integration, utilization of cloud platforms, data visualization capabilities, and use of analytics for decision-making.

Supply chain integration is measured through 4 indicators reflecting information sharing, planning coordination, process integration, and operational collaboration, adapted from Zhang et al. (2009) and Tiwari (2021). Business resilience is measured using five indicators: risk anticipation capability, adaptive capacity, recovery speed, operational flexibility, and organizational learning, adapted from Christopher & Peck (2004) and Ponomarov & Holcomb (2009).

### *Data Collection Procedure*

Data collection was conducted through a combination of online and offline surveys from July to September 2024. The online questionnaire was distributed via Google Forms through WhatsApp and email, utilizing the networks of the East Java Tourism Office, the Indonesian Hotel and Restaurant Association (PHRI), and relevant tourism industry associations. The offline questionnaire was distributed directly through field visits to 12 regencies/cities in East Java with the highest concentration of tourism activities. Before the main data collection, the instrument was tested through a pilot test on 30 respondents. The pilot test results confirmed convergent validity (item-total correlation > 0.30) and adequate reliability (Cronbach's Alpha ≥ 0.70) for all statement items.

### *Data Analysis*

Data analysis was conducted in two stages using SmartPLS 4.0. The first stage was a descriptive analysis to describe the respondent profile and descriptive statistics of the variables. The second stage was PLS-SEM analysis, which included evaluation of the measurement model (outer model) and the structural model (inner model). Evaluation of the outer model included convergent validity (AVE ≥ 0.50; factor loadings ≥ 0.70), discriminant validity (HTMT < 0.85), as well as composite reliability and Cronbach's Alpha (≥ 0.70). The evaluation of the inner model includes the coefficient of determination ($R^2$), effect size ($f^2$), predictive relevance ($Q^2$), and hypothesis testing via bootstrapping with 5,000 subsamples ($p < 0.05$) (Hair et al., 2019).

## RESULTS AND DISCUSSION

### *Respondent Characteristics*

Based on a total of 185 valid questionnaires, most respondents were owners or managers of tourism businesses in various subsectors. Table 1 summarizes the demographic profiles and business characteristics of the respondents.

Table 1. Respondent Characteristics (n = 185)

| Characteristics | Category | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 107 | 57.8 |
| | Female | 78 | 42.2 |
| Age | < 30 years | 34 | 18.4 |
| | 30–39 years | 68 | 36.8 |
| | 40–49 years | 57 | 30.8 |
| | 50 years and older | 26 | 14.1 |
| Business Type | Hotels/Accommodations | 52 | 28.1 |

| | | | |
|---|---|---|---|
| | Restaurants/Food | 43 | 23.2 |
| | Tourist Transportation | 38 | 20.5 |
| | Tourist Destinations/Attractions | 31 | 16.8 |
| | Tour Agencies/Operators | 21 | 11.4 |
| Business Size | Micro (< 5 employees) | 41 | 22.2 |
| | Small (5–19 employees) | 79 | 42.7 |
| | Medium-Large (≥ 20 employees) | 65 | 35.1 |

Source: Primary data, processed (2024)

Table 1 shows that respondents were predominantly male (57.8%), with the 30–39 age group being the largest (36.8%), followed by the 40–49 age group (30.8%). Hotels and accommodations constitute the largest subsector (28.1%), while small businesses dominate the composition (42.7%)—reflecting Indonesia's tourism industry structure, which relies heavily on MSMEs. Adequate cross-subsector representation is a strength of this sample for generalizing findings within the TSC context.

***Measurement Model Evaluation***

A measurement model evaluation was conducted to validate the instrument before hypothesis testing. Table 2 presents the evaluation results, which include factor loadings, Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha.

Table 2. Measurement Model Evaluation Results

| Construct / Indicator | Loading | AVE | CR | Cronbach's α |
|---|---|---|---|---|
| Digital Readiness (DR) | | 0.612 | 0.891 | 0.862 |
| DR1 – IT Infrastructure | 0.798 | | | |
| KD2 – Digital Competence of Human Resources | 0.812 | | | |
| KD3 – Management Support | 0.783 | | | |
| KD4 – Digital Organizational Culture | 0.771 | | | |
| KD5 – Information System Integration | 0.803 | | | |
| BDA Adoption (BDA) | | 0.594 | 0.879 | 0.845 |
| BDA1 – Predictive Analytics | 0.762 | | | |
| BDA2 – Real-time Data Integration | 0.788 | | | |
| BDA3 – Cloud Platform | 0.771 | | | |
| BDA4 – Data Visualization | 0.757 | | | |
| BDA5 – Decision Analytics | 0.793 | | | |
| Supply Chain Integration (SCI) | | 0.608 | 0.861 | 0.804 |
| SCI1 – Information Sharing | 0.801 | | | |
| IRP2 – Planning Coordination | 0.779 | | | |
| IRP3 – Process Integration | 0.761 | | | |
| IRP4 – Operational Collaboration | 0.776 | | | |
| Business Resilience (BR) | | 0.621 | 0.893 | 0.867 |
| BR1 – Risk Anticipation | 0.793 | | | |
| RB2 – Adaptive Capacity | 0.812 | | | |
| RB3 – Recovery Speed | 0.787 | | | |
| RB4 – Operational Flexibility | 0.776 | | | |
| RB5 – Organizational Learning | 0.798 | | | |

Source: Data analysis results from SmartPLS 4.0 (2024)

All indicators have factor loadings above 0.70, confirming good convergent validity. The AVE values for each construct exceed the minimum threshold of 0.50 set by Fornell & Larcker (1981), while the CR and Cronbach's Alpha values all exceed 0.70, indicating satisfactory internal reliability (Hair et al., 2019). The discriminant validity test using the HTMT ratio yielded the highest value of 0.823 between the BDA adoption and supply chain integration constructs—still below the 0.85 threshold recommended by Henseler et al. (2015)—thus, the discriminant validity of all constructs is deemed met.

***Structural Model Evaluation and Hypothesis Testing***

After the measurement model was declared valid and reliable, the analysis proceeded to structural model evaluation via a bootstrapping procedure with 5,000 subsamples. Table 3 summarizes the results of testing the five hypotheses.

Table 3. Hypothesis Test Results (PLS-SEM Bootstrapping, n = 5,000)

| Hypothesis | β | T-stat | P-value | $f^2$ | Decision |
|---|---|---|---|---|---|
| H1: Digital Readiness → BDA Adoption | 0.612 | 8.421 | < 0.001 | 0.413 | Supported |
| H2: BDA Adoption → Supply Chain Integration | 0.578 | 7.893 | < 0.001 | 0.367 | Supported |
| H3: Supply Chain Integration → Business Resilience | 0.543 | 7.124 | < 0.001 | 0.321 | Supported |
| H4: BDA Adoption → Business Resilience | 0.312 | 4.218 | < 0.001 | 0.187 | Supported |
| H5: IRP mediation (BDA → Resilience) | 0.314 | 5.671 | < 0.001 | — | Partial Mediation |

Source: Data analysis results from SmartPLS 4.0 (2024)

All five research hypotheses received strong empirical support. The $R^2$ value for BDA adoption was 0.374 (37.4% of variance explained by digital readiness), supply chain integration 0.334, and business resilience 0.521—indicating that the model explains more than half of the variance in business resilience. The $Q^2$ values for all endogenous variables exceed 0.35, confirming substantial predictive relevance.

***DISCUSSION***

The first hypothesis received strong empirical confirmation. The magnitude of the effect size indicates that this influence is not merely statistically significant but also substantively meaningful. This finding supports Rogers' (2003) argument regarding the diffusion of innovations: organizations with higher absorptive capacity tend to adopt and assimilate new technologies more quickly. In practice, this means that tourism businesses in East Java that have established a sufficient digital foundation—including IT infrastructure, a digitally skilled workforce, and a data-oriented organizational culture—are far better prepared to optimize the benefits of BDA compared to those still operating conventionally.

This finding aligns with Perelygina et al. (2022), who found that successful digital transformation in the travel industry is consistently preceded by a strong foundation of digital readiness. The implication is clear: investment in developing basic digital capabilities is not a cost, but a strategic prerequisite before adopting advanced analytical technologies such as BDA. For many tourism SMEs in East Java, this means a phased approach is necessary, starting with improving employee digital literacy before moving on to the implementation of analytical platforms.

The findings regarding the second hypothesis have confirmed and reinforced the role of BDA as a critical enabler for TSC integration. Tiwari (2021), in his systematic literature review, concluded that BDA is the most influential technology in supply chain integration in the Industry 4.0 era due to its ability to simultaneously connect data from various sources—a claim that has now received empirical confirmation in the context of Indonesian tourism. By adopting BDA- s, tourism businesses can establish a seamless information-sharing system, accurately coordinate capacity planning, and collaborate operationally in responding to fluctuations in tourist demand.

It is important to note that this impact does not occur automatically. Supply chain integration through BDA requires a collective commitment from all actors within the TSC ecosystem to participate in a shared data platform and adopt interoperability standards. In the context of a fragmented tourism industry, this shared governance challenge poses a non-technical barrier that is no less significant than the technical ones.

Furthermore, the third hypothesis is supported and confirms the view of Christopher & Peck (2004) that visibility and collaboration within the supply chain are the main pillars of resilience. When tourism businesses have access to integrated information, they gain the ability to anticipate disruptions before they occur (sensing), quickly adjust capacity and offerings (seizing), and restore operations while minimizing losses (reconfiguring)—three functions that directly build resilience within the framework of Dynamic Capabilities Theory.

The relevance of these findings is highly contextual for Indonesian tourism, which has repeatedly faced various forms of disruption: from natural disasters (the eruption of Mount Semeru, the Cianjur earthquake), sudden policy changes, to global health crises such as the COVID-19 pandemic. Luu et al. (2025), in their bibliometric review of TSC digitalization, concluded that digital integration is the most critical foundation for tourism system resilience, and this study provides empirical confirmation of that finding within the specific context of East Java.

Testing the fourth and fifth hypotheses yielded the most nuanced findings in this study. BDA was found to have a significant direct effect on business resilience; however, its indirect effect through supply chain integration was slightly larger, confirming partial mediation. This implies that BDA builds resilience through two complementary pathways: a direct pathway via improved quality of internal corporate decision-making and a systemic pathway via facilitating the integration of the entire TSC ecosystem.

This pattern of partial mediation is consistent with Dynamic Capabilities Theory (Teece et al., 1997): BDA-based analytical capabilities create value not only through intra-organizational mechanisms but also through the reconfiguration of partnership networks and business ecosystems. This finding clarifies why BDA investment alone, without efforts to build broader supply chain integration, yields more limited resilience impacts compared to an ecosystemic approach.

***BDA-Based Digital Tourism Supply Chain Model***

Based on a synthesis of quantitative analysis results and in-depth interviews with 15 key informants from the business community, academia, and policymakers, this study developed a BDA-Based Digital TSC Model for Indonesian tourism consisting of four mutually integrated architectural layers.

The first layer, the Data Collection Layer, encompasses data collection from various sources: reservation transaction data, traveler social media, IoT sensors at destinations, weather and event data, as well as operational data from all nodes within the TSC. The second layer, the Data Processing Layer, processes large-scale data using cloud computing infrastructure through processes such as cleansing, normalization, cross-source integration, and storage in a centralized data warehouse.

The third layer, the Analytics and Intelligence Layer, is the core of the model. Here, various analytical techniques are applied in a tiered manner: descriptive analytics for real-time performance monitoring, predictive analytics for forecasting tourist demand, prescriptive analytics for optimizing

resource allocation, and machine learning-based cognitive analytics for identifying hidden patterns and personalizing services. The fourth layer, the Application and Collaboration Layer, presents analytical outputs through interactive dashboards for every TSC stakeholder, facilitates cross-stakeholder coordination via an integrated digital platform, and supports data-driven decision-making at all management levels.

This model is designed with three key principles: modularity (each layer can be adopted independently according to the organization's readiness), scalability (can be expanded as digital capabilities grow), and affordability (can be implemented in phases by tourism SMEs with limited resources). Validation through expert judgment from 8 interdisciplinary experts resulted in a positive assessment of the model's relevance, feasibility, and implementation potential within the context of Indonesian tourism.

## CONCLUSION

This study empirically demonstrates that Big Data Analytics-based supply chain digitalization significantly impacts the business resilience of the tourism sector in East Java. All five proposed hypotheses received strong support from PLS-SEM analysis of 185 respondents across tourism subsectors. Three key findings can be highlighted. First, digital readiness is an indispensable prerequisite for BDA adoption; businesses that have established a solid digital foundation exhibit a significantly higher rate of BDA adoption. Second, BDA significantly enhances tourism supply chain integration by facilitating real-time information sharing and operational coordination among business actors. Third, BDA-supported supply chain integration contributes substantially to business resilience, both directly and as a mediator, strengthening capabilities for risk anticipation, adaptation, and recovery from disruptions. From an academic perspective, this study offers three theoretical contributions. First, it extends the application of Dynamic Capabilities Theory to the context of tourism supply chains in developing countries, empirically demonstrating how BDA-based analytical capabilities mediate the relationship between digital readiness and business resilience. Second, this study fills the literature gap identified by Luu et al. (2025) regarding the scarcity of empirical studies on BDA within Southeast Asian tourism TSCs. Third, the resulting BDA-based Digital TSC model offers an implementation architecture framework that can serve as a reference for future research and practitioners.

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