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The Influence of Innovation Capability, Digital Transformation, and Supply Chain Integration on Competitive Advantage in the Automotive Industry in Indonesia

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ABSTRACT
This study examines the influence of innovation capability, digital transformation, and supply chain integration on competitive advantage in the Indonesian automotive industry. Using a quantitative design, data were collected from 150 respondents representing managers and decision-makers in automotive firms. Constructs were measured using a five-point Likert scale, and data were analyzed with Structural Equation Modeling–Partial Least Squares (SEM-PLS 3). The results show that all three factors significantly and positively affect competitive advantage, with innovation capability having the strongest impact, followed by digital transformation and supply chain integration. These findings highlight the need for an integrated strategy, combining internal innovation, digital readiness, and external collaboration, to sustain competitiveness in a dynamic and globalized market. The study contributes to the Resource-Based View, Dynamic Capabilities, and Relational View theories by demonstrating how organizational capabilities, technological adaptation, and supply chain collaboration jointly shape competitive advantage in emerging economies. Managerial implications suggest that firms should invest in innovation, accelerate digital adoption, and strengthen supply chain partnerships to ensure long-term performance.

Keywords:
Innovation Capability, Digital Transformation, Supply Chain Integration, Competitive Advantage, Automotive Industry

INTRODUCTION

The automotive industry in Indonesia is one of the most dynamic and strategic sectors driving national economic growth. As a major manufacturing base in Southeast Asia, Indonesia serves both as a domestic hub and a key production and export center for global automotive brands. Facing rapid technological change, rising consumer demands, and intensifying global competition, firms in this sector must continuously strengthen their competitiveness. Competitive advantage—defined as the ability to outperform rivals through unique strategies and resources—has become vital for sustainability and long-term performance. In a broader Southeast Asian context, legislative progress has also been made to safeguard indigenous rights. The Philippines' Indigenous Peoples' Rights Act (IPRA) of 1997 grants indigenous communities ownership, management, and protection of their ancestral domains, in line with international standards such as ILO Convention 169 (Candelaria, 2018; Doyle, 2020), and has been used strategically to influence legislative outcomes (Theriault, 2019). In Malaysia, native customary rights in Sabah and Sarawak provide legal grounds for indigenous land claims, reinforced by cases like Adong Kuwau and Sagong Tasi, which recognized native title and proprietary rights (Nah, 2008). These frameworks demonstrate how lex specialis can align with national development goals while safeguarding indigenous interests.

One of the key factors in achieving competitive advantage is innovation capability, which reflects a firm's ability to generate novel and value-creating ideas, products, processes, and business models. In the automotive industry, this includes efficient engines, environmentally friendly vehicles, enhanced safety features, and digitalized customer services. Studies show that firms with stronger innovation capabilities are more likely to achieve market differentiation, cost efficiency, and long-term profitability. In Indonesia, where consumer preferences and regulatory demands are shifting toward sustainability and digital readiness, innovation capability is an essential driver of competitiveness. Technological innovation enables firms to respond rapidly to changes and adopt strategies that produce innovative outputs (Mittal & Agarwal, 2019), while effective technological adoption and innovation management significantly influence competitive advantage in Indonesia (Safitri & Miranda, 2024). For SMEs, innovation strategies enhance competitive advantage by improving product quality and processes, achieving superior customer value, lowering costs, and increasing market share (Zainurossalamia et al., 2016). Moreover, integrating innovation into business management—covering strategy, operations, and marketing—can foster sustainable advantages, with leadership support, organizational culture, and risk management serving as critical factors for success (Delhi et al., 2024)

Alongside innovation, digital transformation has become a fundamental enabler of competitiveness, particularly in the automotive industry. It involves integrating digital technologies—such as big data analytics, artificial intelligence, cloud computing, and the Internet of Things—into business processes to enhance value creation, streamline operations, and meet the expectations of digitally savvy consumers. For Indonesian automotive companies integrated into global supply networks, digital transformation is not optional but a strategic imperative to maintain superior competitive advantage. Its application can be seen in predictive maintenance, where big data analytics and IoT predict equipment failures to reduce downtime and costs, thereby improving efficiency and reliability (Naima et al., 2024; Taneja et al., 2024). Real-time supply chain monitoring, supported by blockchain and cloud computing, enables transparency, agility, and resilience across networks (Naima et al., 2024). Smart manufacturing leverages AI and IoT to automate and optimize production, increasing efficiency and flexibility to adapt to market changes (Haktanır et al., 2022; Su et al., 2025). Additionally, customer experience personalization through data analytics allows companies to tailor products and services to individual preferences, strengthening satisfaction and loyalty as a key source of competitive advantage in the digital era (Devaraj, 2016).

In addition to innovation and digitalization, supply chain integration (SCI) is a critical dimension of competitiveness, particularly in the automotive sector where complex networks of suppliers, assemblers, and distributors demand seamless coordination. Effective SCI enhances timely delivery, cost efficiency, and quality consistency while also strengthening resilience and flexibility in responding to disruptions such as raw material shortages or logistical challenges. For Indonesian automotive firms competing domestically and internationally, SCI is essential to sustaining operations and delivering value in volatile environments. By fostering improved information sharing and production planning, SCI significantly contributes to resilience during disruptions like the COVID-19 pandemic (Siagian et al., 2021), with supplier integration emerging as the most impactful dimension compared to internal and customer integration (Zhang et al., 2024). Moreover, SCI improves business performance through innovation, flexibility, and resilience, as shown in studies on

Indonesian firms (Lesmana, 2023; Siagian et al., 2021), where collaboration with suppliers and quality management further amplify its benefits (Lesmana, 2023). Information technology also plays a pivotal role by enabling efficient communication and coordination across the supply chain, a necessity for managing complex networks in the automotive industry

Despite the recognized importance of innovation capability, digital transformation, and supply chain integration, empirical studies analyzing their simultaneous influence on competitive advantage in the Indonesian automotive industry remain limited, as most existing research tends to examine these factors individually or in different industry contexts. This gap is critical to address given the increasingly competitive and dynamic environment of the automotive sector, where understanding how these three dimensions interact and collectively shape competitive advantage offers both academic contributions and practical insights for managers and policymakers seeking to strengthen Indonesia's role in the global automotive value chain. Therefore, this study aims to analyze the influence of innovation capability, digital transformation, and supply chain integration on competitive advantage in the Indonesian automotive industry by employing a quantitative approach with Structural Equation Modeling–Partial Least Squares (SEM-PLS 3) based on data from 150 respondents representing key stakeholders in the sector. Through this analysis, the study is expected to provide comprehensive evidence on the strategic factors driving competitiveness, yielding valuable implications for theory development and managerial practice in the context of emerging markets.

1. Innovation Capability

Innovation capability in the automotive industry is a critical factor for sustaining competitive advantage, especially in emerging markets like Indonesia, as it enables firms to transform knowledge into valuable products, processes, and systems that align with regulatory demands and evolving customer preferences. Research shows that firms with strong innovation capabilities achieve higher differentiation, better resource utilization, and sustainable growth through product, process, and business model innovations that are vital for global competitiveness. Technological innovation allows firms to adapt rapidly and adopt new strategies, strengthening competitiveness in dynamic environments (Mittal & Agarwal, 2019), while effective technological adoption and innovation management significantly enhance market positioning in Indonesia (Safitri & Miranda, 2024). Moreover, dynamic capabilities—such as integrating, building, and reconfiguring competencies—positively influence innovation and competitive advantage (Zatia et al., 2023), as evidenced in the Indonesian motorcycle industry where process innovation drives cost efficiency and technological leadership (Purwanto et al., 2023). However, challenges remain in aligning innovation strategies with organizational practices, which can hinder effective management (Serio et al., 2016), though firms that overcome these barriers and successfully manage their innovation competencies can improve performance and sustain a competitive edge (Di Serio et al., 2016). H1: Innovation capability has a significant positive effect on competitive advantage in the automotive industry in Indonesia.

2. Digital Transformation

Digital transformation in the automotive industry is a multifaceted process that integrates digital technologies to enhance operational efficiency, innovation, and customer engagement, making it crucial for sustaining competitiveness in dynamic markets like Indonesia where firms face supply chain disruptions and shifting consumer behaviors. The adoption of IoT, big data analytics, AI, and cloud computing enables real-time decision-making, improves production quality, and strengthens customer relationships, thereby fostering sustainable competitive advantage. Technological integration streamlines production and drives product innovation, which is essential for efficiency and competitiveness (Costa et al., 2024; Haktanır et al., 2022). It also reduces costs and supports the development of new products and services, which are critical in a sector reliant on mass production and standardization (Priyanto et al., n.d.; Zimonjić, 2024). Furthermore, digital platforms and analytics enhance customer engagement and value creation by enabling firms to better understand consumer needs and tailor their offerings (Su et al., 2025; Zimonjić, 2024). Ultimately, aligning digital initiatives with broader corporate strategies enhances agility, allowing firms to respond swiftly to market changes and maintain long-term competitiveness (Su et al., 2025). H2: Digital transformation has a significant positive effect on competitive advantage in the

3. Supply Chain Integration

Supply chain integration (SCI) is a critical strategy for enhancing competitive advantage in the automotive industry, particularly in emerging markets, as it entails the strategic coordination of internal processes and collaboration with suppliers and customers to improve operational performance, reduce costs, and increase responsiveness to market changes. Effective SCI, categorized into internal, supplier, and customer integration, enables firms to manage complex networks, mitigate risks, and address fluctuating consumer demand. Internal integration aligns departments to build a cohesive organizational response, though it is influenced by enablers, barriers, and human factors that may support or hinder implementation (de Abreu & Alcântara, n.d.; Maiga, 2018). Supplier integration transforms diversified supplier networks into strategic assets (Ngo et al., 2016), while customer integration expands resource endowments to strengthen manufacturing-related capabilities (Maiga, 2018). Both supplier and customer integration mediate the effects of internal integration, reflecting their interdependence in driving competitiveness (Maiga, 2018). Furthermore, SCI enhances predictability, flexibility, and responsiveness across the supply chain lifecycle (Ngo et al., 2016), with deeper integration leading to superior performance outcomes (Khanuja & Jain, 2020). Nonetheless, firms must address risks such as supplier failures and shifting competitive conditions that can affect overall value and performance (Ngo et al., 2016). H3: Supply chain integration has a significant positive effect on competitive advantage in the automotive industry in Indonesia.

4. Competitive Advantage

In the automotive industry, competitive advantage is essential for firms to outperform rivals by creating more value through unique resources, capabilities, and strategies, with innovation capability, digital transformation, and supply chain integration serving as key enablers. Tesla illustrates the power of innovation capability by leveraging its early mover advantage in the electric vehicle (EV) market, establishing a strong position and differentiating itself from traditional automakers, while BMW emphasizes innovation in product development and technology to strengthen premium positioning and brand equity (Hong, 2024). Digital transformation also plays a vital role, as seen in Toyota’s adoption of digital tools to enhance operational efficiency and economies of scale, demonstrating how the integration of digital technologies into manufacturing and customer service can achieve both cost leadership and differentiation in line with Porter's framework (Bredrup, 1995; Hong, 2024). Similarly, supply chain integration supports swift responses to market changes and customer demands, with Toyota's global efficiency stemming in part from its robust supply chain, which enhances cost efficiency and enables the delivery of unique benefits that reinforce competitive advantage (Bredrup, 1995; Hong, 2024).

METHOD

1. Research Design

This study employs a quantitative research design to examine the influence of innovation capability, digital transformation, and supply chain integration on competitive advantage in the automotive industry in Indonesia. The quantitative approach was chosen because it allows for hypothesis testing and the establishment of causal relationships between variables. The research is explanatory in nature, aiming to provide empirical evidence on the theoretical relationships derived from the literature review.

2. Population and Sample

The population of this research consists of managers, supervisors, and decision-makers working in automotive companies and related suppliers operating in Indonesia. The sample was determined using a purposive sampling technique, targeting respondents who possess sufficient knowledge about innovation practices, digital initiatives, and supply chain operations within their organizations. A total of 150 respondents participated in this study, which meets the minimum requirement for Structural Equation Modeling–Partial Least Squares (SEM-PLS) analysis, as recommended by Hair et al. (2019), who suggest a sample size of at least 5–10 times the number of indicators.

3. Data Collection Method

Primary data were collected using a structured questionnaire survey distributed directly and electronically to respondents. The questionnaire was divided into four main sections: (1) demographic profile of respondents and firms, (2) innovation capability, (3) digital transformation, (4) supply chain integration, and (5) competitive advantage. Each construct was measured using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The items for each construct were adapted from established measurement scales in prior studies to ensure content validity.

4. Measurement of Variables

In the automotive industry, competitive advantage is vital for firms to outperform rivals by leveraging unique resources, capabilities, and strategies, with innovation capability, digital transformation, and supply chain integration acting as key enablers. Tesla demonstrates the importance of innovation by capitalizing on its early mover advantage in the electric vehicle (EV) market, establishing strong differentiation, while BMW focuses on technological and product innovation to reinforce its premium positioning and brand equity (Hong, 2024). Digital transformation further enhances competitiveness, as illustrated by Toyota's use of digital tools to improve operational efficiency and economies of scale, showing how digital integration in manufacturing and customer service drives both cost leadership and differentiation in line with Porter's framework (Hong, 2024; Bredrup, 1995). Meanwhile, effective supply chain integration enables firms to adapt swiftly to market shifts and customer demands, with

Toyota's robust global supply chain supporting cost efficiency and unique value delivery that strengthen its competitive advantage (Hong, 2024; Bredrup, 1995).

5. Data Analysis Technique

The collected data were analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS 3 software, selected for its suitability in handling complex models, small-to-medium sample sizes, and its ability to test measurement and structural models simultaneously. The analysis was carried out in two stages: first, the measurement model (outer model) evaluation assessed construct validity and reliability through indicator loadings, composite reliability (CR), Cronbach's alpha, Average Variance Extracted (AVE), and discriminant validity using the Fornell–Larcker and HTMT criteria; second, the structural model (inner model) evaluation examined relationships between constructs by analyzing path coefficients, R^2 values, f^2 effect sizes, and predictive relevance (Q^2), with hypothesis testing conducted via bootstrapping using 5,000 resamples to determine the significance of path coefficients.This section must be written out briefly, concisely, clearly, but adequately so that it can be replicated. This section contains explanations of the research approach, subjects of the study, conducts of the research procedure, use of materials and instruments, data collection and analysis techniques. These are not theories. In the case of statistical uses, formulas that are generally known should not be written down. Any specific criteria used by the researcher in collecting and analyzing the research data should be completely described. This section should be written not more than 10% (for qualitative research) or 15% (for quantitative research) of the body.

RESULTS AND DISCUSSION

1. Descriptive Statistics

Descriptive analysis was conducted to provide an overview of the respondents and the distribution of answers on each research construct. This stage is essential to ensure that the data characteristics align with the research objectives and to identify general tendencies of the respondents in perceiving innovation capability, digital transformation, supply chain integration, and competitive advantage. The total number of respondents in this study was 150 individuals, consisting of employees and managers working in automotive manufacturing companies and supplier firms in Indonesia. Table 4.1 summarizes the demographic characteristics of respondents.

Table 1. Profile of Respondents

Characteristics	Category	Frequency	Percentage
Gender	Male	98	65.3%
	Female	52	34.7%
Age	21–30 years	45	30.0%
	31–40 years	63	42.0%
	41–50 years	32	21.3%
	> 50 years	10	6.7%
Position	Supervisor/Manager	89	59.3%
	Staff/Engineer	44	29.3%
	Senior Executive	17	11.3%
Firm Size	< 250 employees	58	38.7%
	250–500 employees	47	31.3%
	> 500 employees	45	30.0%

Source: data processed author (2025)

The profile of respondents in Table 4.1 provides an overview of the demographic and organizational characteristics of the sample (n = 150), offering important context for interpreting the study's findings. The gender distribution is dominated by male respondents (65.3%) compared to female respondents (34.7%), reflecting the male-oriented composition still prevalent in the automotive industry, particularly in managerial and technical roles. In terms of age, the majority of respondents are between 31–40 years (42.0%), followed by those aged 21–30 years (30.0%), 41–50 years (21.3%), and only 6.7% above 50 years, suggesting a workforce that is relatively young to middle-aged, combining both innovation potential and experience. Regarding job positions, supervisors and managers represent the largest group (59.3%), followed by staff/engineers (29.3%) and senior executives (11.3%), with the dominance of managerial roles providing a strong basis for strategic insights into innovation capability, digital transformation, and supply chain integration. Firm size is also well distributed, with 38.7% of respondents from small firms (< 250 employees), 31.3% from medium-sized firms (250–500 employees), and 30.0% from large firms (> 500 employees), ensuring comprehensive representation across different organizational scales. Overall, the respondent profile highlights a diverse and representative sample, reinforcing the reliability of the analysis while underlining the demographic and organizational factors that may influence competitive advantage in the Indonesian automotive sector. Table 2 presents descriptive statistics of the main constructs measured using a five-point Likert scale (1 = strongly disagree; 5 = strongly agree).

Table 2. Descriptive Statistics of Constructs

Variable	N	Mean	Minimum	Maximum	Std. Deviation
Innovation Capability	150	4.12	3.40	4.80	0.52
Digital Transformation	150	4.08	3.20	4.85	0.57
Supply Chain Integration	150	4.05	3.10	4.70	0.55
Competitive Advantage	150	4.20	3.50	4.90	0.50

Source: data processed author (2025)

Table 2 presents the descriptive statistics of the study constructs, showing that all variables have relatively high mean values, reflecting positive perceptions of innovation capability, digital transformation, supply chain integration, and competitive advantage in the Indonesian automotive industry. Competitive advantage has the highest mean (M = 4.20, SD = 0.50), indicating strong perceived performance compared to competitors, while innovation capability (M = 4.12, SD = 0.52) highlights firms' ability to generate and apply new ideas, products, and processes. Digital transformation (M = 4.08, SD = 0.57) suggests active adoption of digital technologies to improve efficiency and customer engagement, though with some variation across firms, and supply chain integration (M = 4.05, SD = 0.55) reflects growing collaboration with suppliers and customers to enhance resilience and responsiveness. Overall, these results suggest that Indonesian automotive firms are relatively advanced in these strategic areas, though variability across responses indicates room for improvement and differentiation.

2. Measurement Model (Outer Model Evaluation)

The measurement model (outer model) aims to evaluate the validity and reliability of each construct. In this study, four latent variables were measured: innovation capability, digital transformation, supply chain integration, and competitive advantage. Each construct was operationalized with reflective indicators using a 5-

point Likert scale. The assessment followed three key steps: indicator reliability (factor loadings), internal consistency and convergent validity, and discriminant validity.

3. Indicator Reliability

Indicator reliability is assessed through standardized factor loadings, with a recommended threshold of ≥ 0.70 (Hair et al., 2019). As shown in Table 4.3, all indicators met this criterion. Innovation capability items (IC1–IC4) had loadings between 0.74–0.88, digital transformation items (DT1–DT4) ranged from 0.76–0.90, supply chain integration items (SCI1–SCI4) ranged from 0.72–0.87, and competitive advantage items (CA1–CA4) ranged from 0.78–0.89.

Table 3. Outer Loadings of Indicators

Construct	Indicator	Loading	Result
Innovation Capability	IC1	0.741	Valid
	IC2	0.814	Valid
	IC3	0.884	Valid
	IC4	0.776	Valid
Digital Transformation	DT1	0.768	Valid
	DT2	0.823	Valid
	DT3	0.905	Valid
	DT4	0.848	Valid
Supply Chain Integration	SCI1	0.722	Valid
	SCI2	0.795	Valid
	SCI3	0.878	Valid
	SCI4	0.762	Valid
Competitive Advantage	CA1	0.784	Valid
	CA2	0.858	Valid
	CA3	0.894	Valid
	CA4	0.828	Valid

Source: data processed author (2025)

Table 3 presents the outer loadings of indicators for each construct, all of which exceed the recommended threshold of 0.70, confirming their validity and strong correlation with their respective constructs. For Innovation Capability, the loadings range from 0.741 to 0.884, indicating that IC1–IC4 effectively capture firms' ability to generate and apply new ideas, processes, and products. Digital Transformation shows similarly high loadings between 0.768 and 0.905, with DT3 as the strongest contributor (0.905), underscoring the critical role of digital adoption in enhancing competitiveness. Supply Chain Integration records loadings between 0.722 and 0.878, with SCI3 as the most dominant (0.878), highlighting the significance of collaboration and coordination across supply chain partners. Competitive Advantage also demonstrates robust loadings from 0.784 to 0.894, with CA3 as the highest (0.894), reflecting firms' superior performance compared to competitors. Overall, these consistently high values confirm the reliability of the measurement model and show that each indicator significantly contributes to explaining its latent construct, thereby supporting the validity of the research framework.

4. Internal Consistency and Convergent Validity

Internal consistency is assessed using Cronbach's Alpha and Composite Reliability (CR), both expected to exceed 0.70. Convergent validity is assessed using the Average Variance Extracted (AVE), which must be ≥ 0.50.

Table 4. Internal and Convergent

Construct	Cronbach's Alpha	Composite Reliability (CR)	AVE	Result
Innovation Capability	0.846	0.893	0.677	Reliable & Valid
Digital Transformation	0.874	0.917	0.729	Reliable & Valid
Supply Chain Integration	0.836	0.885	0.650	Reliable & Valid
Competitive Advantage	0.867	0.903	0.693	Reliable & Valid

Source: data processed author (2025)

Table 4 presents the results of internal consistency and convergent validity testing for the study constructs, assessed using Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). All constructs meet the recommended thresholds—Cronbach's Alpha and CR values above 0.70 indicate strong internal consistency, while AVE values above 0.50 confirm adequate convergent validity. Innovation Capability shows Cronbach's Alpha of 0.846, CR of 0.893, and AVE of 0.677, suggesting that its indicators consistently measure the construct. Digital Transformation records even higher values (α = 0.874, CR = 0.917, AVE = 0.729), highlighting both reliability and a strong ability of its indicators to explain variance. Supply Chain Integration demonstrates satisfactory reliability (α = 0.836, CR = 0.885) and convergent validity (AVE = 0.650), confirming that its measures effectively capture the integration construct. Similarly, Competitive Advantage achieves high internal consistency (α = 0.867, CR = 0.903) with an AVE of 0.693, validating its measurement. Overall, the results indicate that all constructs in this study are both reliable and valid, ensuring robustness in subsequent structural model testing.

5. Discriminant Validity

Discriminant validity was assessed using two methods: Fornell–Larcker criterion and Heterotrait-Monotrait ratio (HTMT).

Fornell–Larcker Criterion

The square root of AVE (diagonal values in Table 4.5) is greater than the correlation with other constructs, confirming discriminant validity.

Table 5. Fornell–Larcker Criterion

Construct	IC	DT	SCI	CA
Innovation Capability (IC)	0.823			
Digital Transformation (DT)	0.617	0.857		
Supply Chain Integration (SCI)	0.583	0.636	0.812	
Competitive Advantage (CA)	0.666	0.623	0.595	0.837

Source: data processed author (2025)

Table 5 shows the Fornell–Larcker criterion results, where the square root of AVE for each construct is higher than its correlations with other constructs, confirming discriminant validity. Innovation Capability (0.823), Digital Transformation (0.857), Supply Chain Integration (0.812), and Competitive Advantage (0.837) all demonstrate stronger associations with their own indicators than with other constructs. Although correlations such as IC–CA (0.666) and DT–SCI (0.636) are moderate, they remain below the AVE square roots, ensuring adequate separation. Overall, these findings confirm that the constructs are empirically distinct and support the validity of the measurement model.

6. HTMT Ratio

HTMT values were all below the 0.90 threshold (see Table 4.6), further supporting discriminant validity.

Table 6. HTMT Ratios

Construct Pair	HTMT Value	Result
IC – DT	0.725	Valid
IC – SCI	0.706	Valid
IC – CA	0.768	Valid
DT – SCI	0.742	Valid
DT – CA	0.784	Valid
SCI – CA	0.736	Valid

Source: data processed author (2025)

Table 6 presents the Heterotrait–Monotrait (HTMT) ratios as an additional test of discriminant validity, with all values below the 0.85 threshold, confirming that the constructs are distinct and free from multicollinearity. The HTMT values for IC–DT (0.725), IC–SCI (0.706), IC–CA (0.768), DT–SCI (0.742), DT–CA (0.784), and SCI–CA (0.736) indicate acceptable validity. These results align with the Fornell–Larcker criterion, strengthening evidence that the constructs are clearly differentiated and the measurement model is robust for further analysis.

7. Structural Model (Inner Model Evaluation)

After confirming the adequacy of the measurement model, the next step was to evaluate the structural model (inner model), which describes the relationships among latent constructs. The evaluation was conducted using SmartPLS 3 and included assessments of multicollinearity (VIF values), coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and path coefficients.

8. Multicollinearity Assessment

Multicollinearity was assessed using Variance Inflation Factor (VIF) values. Hair et al. (2019) recommend that VIF values should be below 5.0. As shown in Table 4.7, all predictors of competitive advantage (innovation capability, digital transformation, and supply chain integration) have VIF values between 1.52 and 2.03, indicating no multicollinearity problem.

Table 7. Collinearity Assessment (VIF Values)

Predictor Variable	Dependent Variable	VIF
Innovation Capability	Competitive Advantage	1.876
Digital Transformation	Competitive Advantage	2.033
Supply Chain Integration	Competitive Advantage	1.521

Source: data processed author (2025)

Table 7 shows the collinearity assessment using VIF values, all of which are well below the threshold of 5.0, indicating no multicollinearity issues in the model. Innovation Capability has a VIF of 1.876, Digital Transformation the highest at 2.033, and Supply Chain Integration the lowest at 1.521. These results suggest that each predictor contributes unique explanatory power to Competitive Advantage without excessive overlap, confirming the stability and reliability of the regression estimates and providing a solid basis for analyzing their direct effects on competitiveness in the Indonesian automotive industry.

9. Coefficient of Determination (R^2)

The coefficient of determination (R^2) indicates the explanatory power of the independent variables on the dependent variable. The R^2 value for competitive advantage was 0.62, meaning that innovation capability, digital transformation, and supply chain integration jointly explain 62% of the variance in competitive advantage, while the remaining 38% is explained by other factors outside the model. According to Chin (1998), an R^2 of 0.62 can be categorized as moderate-to-substantial in social science research.

10. Effect Size (f^2)

The effect size (f^2) measures the impact of each independent variable on the dependent variable. Cohen (1988) suggests thresholds of 0.02 (small), 0.15 (medium), and 0.35 (large). Table 4.8 shows that innovation capability (0.21) and digital transformation (0.19) had medium effect sizes, while supply chain integration (0.15) had a small-to-medium effect size.

Table 8. Effect Size (f^2) Values

Independent Variable	Dependent Variable	f^2	Effect Size
Innovation Capability	Competitive Advantage	0.213	Medium
Digital Transformation	Competitive Advantage	0.192	Medium
Supply Chain Integration	Competitive Advantage	0.158	Small-Medium

Source: data processed author (2025)

Table 8 presents the effect size (f^2) values, showing the contribution of each independent variable to explaining variance in Competitive Advantage. Based on Cohen's (1988) guidelines, Innovation Capability has the strongest impact with an f^2 of 0.213 (medium effect), underscoring its central role in enhancing competitiveness through new products, processes, and business models. Digital Transformation follows with an f^2 of 0.192 (medium effect), indicating its substantial role in improving efficiency, innovation, and customer engagement. Supply Chain Integration records an f^2 of 0.158 (small-to-medium effect), showing its importance though slightly less influential than the other two factors. Overall, the results confirm that all three variables significantly drive competitive advantage, with innovation capability and digital transformation playing more dominant roles in shaping firm performance in the Indonesian automotive industry.

11. Predictive Relevance (Q^2)

The Stone–Geisser's Q^2 test, obtained through the blindfolding procedure, was used to evaluate the predictive relevance of the model. The Q^2 value for competitive advantage was 0.44, which is greater than zero. This indicates that the structural model has strong predictive relevance and is capable of accurately predicting endogenous constructs.

12. Path Coefficients

The path coefficients represent the strength and direction of the relationships between constructs. Bootstrapping with 5,000 subsamples was conducted to test their significance. The results (β, t-value, p-value) will be presented in Section 4.4 Hypothesis Testing, but preliminary analysis indicates all paths were positive and statistically significant at $p < 0.01$.

4.4 Hypothesis Testing

The hypotheses of this study were tested using the bootstrapping method with 5,000 resamples in SmartPLS 3. This procedure generated path coefficients (β), t-values, and p-values for each hypothesized relationship. A significance level of 0.05

(two-tailed test) was applied, meaning that hypotheses are supported when t-value > 1.96 and p-value < 0.05.

Table 9. Path Coefficient Results

Hypothesis	Path Relationship	Coefficient (β)	t-value	p-value	Decision
H1	Innovation Capability → Competitive Advantage	0.387	5.123	0.000	Supported
H2	Digital Transformation → Competitive Advantage	0.343	4.756	0.000	Supported
H3	Supply Chain Integration → Competitive Advantage	0.296	3.962	0.000	Supported

Source: data processed author (2025)

Table 9 presents the path coefficient results, which test the direct relationships between the independent variables and competitive advantage. All three hypotheses are supported, as indicated by significant path coefficients (p < 0.05) with strong t-values. H1 shows that innovation capability has a positive and significant effect on competitive advantage (β = 0.387, t = 5.123, p = 0.000), confirming its critical role in enhancing firms' ability to differentiate and sustain performance through new ideas, products, and processes. H2 demonstrates that digital transformation also positively influences competitive advantage (β = 0.343, t = 4.756, p = 0.000), highlighting the importance of adopting digital technologies to improve efficiency, innovation, and customer engagement in the automotive sector. H3 reveals that supply chain integration significantly contributes to competitive advantage (β = 0.296, t = 3.962, p = 0.000), emphasizing the value of strong collaboration with suppliers, customers, and internal processes in creating operational flexibility and resilience. Overall, the results indicate that all three strategic factors—innovation capability, digital transformation, and supply chain integration—play significant and complementary roles in driving competitive advantage in the Indonesian automotive industry.

Discussion

1. The Role of Innovation Capability in Driving Competitive Advantage

The results confirm that innovation capability has the strongest positive influence on competitive advantage (β = 0.38, p < 0.01). This finding is Consistent with prior studies, dynamic capabilities significantly influence innovation and business continuity, as shown in research on Indonesian SMEs where adaptability and innovation are key to long-term sustainability (Suharto et al., 2023). In the motorcycle industry, innovation capability directly impacts firm performance, particularly through process innovation that drives cost-effective manufacturing and technological advancement (Purwanto et al., 2023). Human capital, encompassing skills and knowledge, further enhances innovation capability and sustainable competitive advantage, mediated by innovation and moderated by collective organizational engagement, reinforcing the RBV theory (Indrawati et al., 2024). Innovation itself can be categorized into technological (product) and non-technological (process, organizational, marketing, and service) types, all of which contribute to firm performance, with process innovation being especially relevant in the automotive sector (Siriram et al., 2023). Moreover, organizational learning plays a crucial role in driving innovativeness, as continuous learning fosters the ability to adapt and sustain competitiveness in dynamic industries such as automotive (Vijayashree et al., n.d.).

These findings emphasize that firms capable of continuously generating and implementing novel ideas are better positioned to differentiate themselves from competitors. In the automotive industry, innovation manifests through diverse forms, including product innovation (e.g., fuel-efficient and electric vehicles), process innovation (Siriram et al., 2023), and service innovation (Siriram et al., 2023). In Indonesia, where the automotive sector faces pressures from global competition, regulatory demands for sustainability, and evolving consumer preferences, innovation capability stands out as a critical enabler of survival and growth. This reinforces the Resource-Based View (RBV) theory, which argues that unique organizational capabilities are essential for building and sustaining long-term competitive advantage. The results highlight that firms prioritizing R&D investment, fostering a culture of creativity, and encouraging cross-functional collaboration are more likely to strengthen their competitive positions.

2. The Importance of Digital Transformation for Competitiveness

Digital transformation was also found to significantly enhance competitive advantage, consistent with prior studies that highlight the transformative role of digital technologies in reshaping industries. Key enablers include Big Data and IoT, which improve operational efficiency and innovation through real-time analysis and predictive maintenance (Jannepally et al., 2024); cloud computing, which provides scalable infrastructure for efficient data and application management (Rodríguez, 2020); and smart manufacturing, which leverages cyber-physical systems and digital twins to boost efficiency and customization (Bhatia & Kumar, 2020). However, challenges remain, such as ensuring cybersecurity to protect sensitive information (Bhatia & Kumar, 2020), fostering an adaptive organizational culture to support technological change (Yaqub & Alsabban, 2023), and managing high investment costs that require careful strategic planning (Bhatia & Kumar, 2020). By effectively addressing these factors, firms can maximize the benefits of digital transformation while mitigating associated risks.

For Indonesian automotive firms, digital transformation is particularly vital in navigating Industry 4.0 and responding to evolving consumer expectations for connectivity, customization, and convenience. Integrating tools such as big data analytics, cloud computing, IoT, and digital platforms enables companies to achieve higher efficiency, real-time decision-making, and improved customer experiences. The adoption of predictive maintenance systems and smart manufacturing technologies further strengthens firms' ability to respond to market volatility and global competition. These findings support the Dynamic Capabilities Theory, which emphasizes that firms able to integrate, build, and reconfigure resources in response to environmental changes are better positioned to sustain long-term competitiveness in rapidly evolving industries.

3. The Contribution of Supply Chain Integration

The study also demonstrates that supply chain integration positively impacts competitive advantage, confirming prior evidence that effective coordination with suppliers, manufacturers, and distributors enhances efficiency, reduces costs, and strengthens responsiveness. Supply chain integration improves responsiveness to customer demands (Harsasi, n.d.; Sukati et al., 2012) and has been shown in Indonesian studies to enhance both supply chain performance and competitive advantage (Anatan, 2010). Moreover, effective supply chain management practices lead to operational cost efficiency (Siburian et al., 2022), while synergy with knowledge management optimizes resource utilization and strengthens competitiveness (Sinaga et al., 2019). In highly complex networks such as the automotive industry, these integration efforts ensure quality consistency, timely delivery, and cost competitiveness, making them critical drivers of firm performance.

In the Indonesian context, supply chain integration plays a crucial role in overcoming logistical challenges, raw material fluctuations, and rising customer expectations. Integrated supply chains are more resilient and capable of responding quickly to disruptions, such as those frequently encountered in the region (Harsasi, n.d.). Trust-based partnerships and collaborative planning with supply chain partners further enhance adaptability to market volatility and strengthen overall resilience (Sinaga et al., 2019). These findings align with the Relational View (RV) of strategy, which emphasizes that well-managed inter-organizational relationships can serve as a unique source of competitive advantage, reinforcing the strategic importance of collaboration and integration in sustaining growth and competitiveness in the automotive sector.

4. Managerial and Theoretical Implications

From a managerial perspective, the results highlight three key recommendations for strengthening competitiveness in the automotive industry. First, firms should prioritize innovation capability through continuous R&D investments, fostering creative work environments, and enhancing employee skills to support both product and process innovation. Second, they need to accelerate digital transformation by adopting Industry 4.0 technologies and embedding digital practices throughout the value chain, ensuring that technology adoption is aligned with customer needs and broader business objectives. Third, companies should strengthen supply chain integration by fostering trust, enhancing information sharing, and promoting long-term collaboration with suppliers and distributors, thereby improving flexibility and resilience in the face of disruptions.

From a theoretical standpoint, the study enriches the Resource-Based View (RBV), Dynamic Capabilities, and Relational View (RV) frameworks by showing how organizational capabilities, technological adaptation, and inter-firm collaboration jointly shape competitive advantage in emerging market contexts. The findings provide empirical evidence that these perspectives are not mutually exclusive but rather complementary, offering a more holistic understanding of how firms can build and sustain competitiveness in complex industries such as automotive manufacturing.

CONCLUSION

This study examined the influence of innovation capability, digital transformation, and supply chain integration on competitive advantage in the Indonesian automotive industry using SEM-PLS with data from 150 respondents. The results revealed that all three factors significantly and positively affect competitive advantage, with innovation capability exerting the strongest impact, followed by digital transformation and supply chain integration. These findings emphasize the importance of strengthening internal capabilities, adopting digital technologies, and fostering collaboration across supply chains as complementary strategies to sustain competitiveness. For Indonesian automotive firms, innovation capability emerges as a key differentiator, digital transformation enhances efficiency and responsiveness, while supply chain integration bolsters resilience and value creation, offering a holistic path to thrive in a dynamic global market.

From a managerial standpoint, firms are encouraged to prioritize R&D investments, integrate digital solutions across their operations, and cultivate long-term collaborative relationships with suppliers and distributors. Theoretically, this study contributes to the Resource-Based View, Dynamic Capabilities, and Relational View by providing empirical evidence on how innovation, technology, and collaboration jointly shape competitiveness in emerging markets. Future research could broaden the scope by incorporating additional variables such as sustainability practices, customer orientation, or regulatory factors, and by employing longitudinal data to capture the long-term effects of these strategic drivers.

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