

Analysis of Strategic Agility and Digital Transformation on Innovation Capability and Competitive Advantage in Technology Startups in Bandung

Henry Fitriani¹, Siska Mayratih², Lena Erdawati³, Eko Sudarmanto⁴

¹ Politeknik PGRI Banten

²⁻⁴ Universitas Muhammadiyah Tangerang

Article Info

Article history:

Received Aug, 2026

Revised Aug, 2026

Accepted Aug, 2026

Keywords:

Competitive Advantage

Digital Transformation

Innovation Capability

Strategic Agility

Technology Startups

ABSTRACT

This study examines the effects of strategic agility and digital transformation on innovation capability and competitive advantage among technology startups in Bandung, Indonesia. A quantitative research design was employed using a cross-sectional survey involving 190 respondents who were directly engaged in technology startup activities. Data were collected through a structured questionnaire using a five-point Likert scale and analyzed through Partial Least Squares Structural Equation Modeling using SmartPLS 3. The findings show that strategic agility has a positive and significant effect on innovation capability and competitive advantage. Digital transformation also has a positive and significant effect on innovation capability and competitive advantage. Innovation capability has a strong positive and significant effect on competitive advantage. Furthermore, innovation capability significantly mediates the relationships between strategic agility and competitive advantage and between digital transformation and competitive advantage. The model explains 68.4% of the variance in innovation capability and 75.6% of the variance in competitive advantage. These findings indicate that technology startups can strengthen their competitive position by combining strategic responsiveness, digital integration, and continuous innovation. The study contributes to the Resource-Based View and Dynamic Capabilities perspective by demonstrating that innovation capability functions as a key mechanism through which strategic agility and digital transformation generate competitive value.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Name: Henry Fitriani

Institution Address: Politeknik PGRI Banten

e-mail: heny.fitriani88@gmail.com

1. INTRODUCTION

The rapid advancement of digital technologies has fundamentally transformed the competitive landscape and created both opportunities and challenges for technology-based startups. The increasing adoption of artificial intelligence, cloud computing, big

data analytics, digital platforms, and automation has accelerated changes in customer behavior, market structures, and business models. These pressures are particularly relevant for technology startups, which commonly operate under conditions of

high uncertainty, limited resources, short innovation cycles, and intense competition [1], [2]. Unlike conventional firms, technology startups depend heavily on experimentation, scalability, technological development, and rapid market responses. Consequently, their survival and competitiveness depend not only on access to technological resources but also on their ability to respond rapidly to environmental changes, reconfigure resources, integrate digital technologies, and continuously generate innovation [3], [4]. Within this context, strategic agility and digital transformation represent critical organizational capabilities for developing sustainable competitive advantage.

Strategic agility refers to an organization's capacity to recognize environmental changes, make timely strategic decisions, and rapidly reconfigure organizational resources in response to emerging opportunities and threats. [5], [6] conceptualize strategic agility through strategic sensitivity, leadership unity, and resource fluidity, which collectively enable firms to identify market developments, coordinate strategic decisions, and reallocate resources efficiently. From the perspective of Dynamic Capabilities Theory, these characteristics reflect the ability to sense changes, seize opportunities, and reconfigure organizational resources in dynamic environments [7], [8]. Strategic agility is therefore particularly relevant to technology startups, where existing technologies and business models can rapidly become obsolete. Greater strategic agility may enable startups to experiment with alternative business models, respond more effectively to technological disruption, and mobilize resources toward promising opportunities [9], [10]. Such capabilities are also expected to strengthen innovation capability because agile organizations can identify opportunities earlier and translate strategic responses into new products, services, processes, and business models.

Alongside strategic agility, digital transformation has become an increasingly important determinant of organizational competitiveness. Digital transformation

involves broader organizational changes arising from the strategic integration of digital technologies into business processes, customer interactions, organizational structures, and mechanisms of value creation [11], [12]. For technology startups, digital technologies can improve operational flexibility, scalability, connectivity, knowledge sharing, and data-driven decision-making. Cloud infrastructure, digital platforms, analytics, and collaborative technologies can also facilitate rapid prototyping, continuous customer feedback, and shorter product development cycles [13], [14]. However, the possession or adoption of digital technologies alone does not necessarily produce superior competitive outcomes. Their strategic value depends on the organization's capacity to transform digital resources into commercially meaningful innovations. Innovation capability therefore represents an important mechanism through which both strategic agility and digital transformation can contribute to competitive advantage.

The relationships among strategic agility, digital transformation, innovation capability, and competitive advantage can be explained through the complementary perspectives of the Resource-Based View (RBV) and Dynamic Capabilities Theory. According to the RBV, competitive advantage originates from valuable, rare, imperfectly imitable, and non-substitutable organizational resources and capabilities [15]. However, in technology-intensive environments, competitive advantage cannot depend solely on static resources because technological changes can rapidly diminish their economic value. Dynamic Capabilities Theory extends this perspective by emphasizing the ability of firms to integrate, build, and reconfigure resources in response to environmental changes [16]. Within this integrated framework, strategic agility facilitates rapid strategic responses, digital transformation provides and integrates technological resources, and innovation capability converts these resources and capabilities into differentiated market value. Thus, innovation capability may not only

directly strengthen competitive advantage but also mediate the effects of strategic agility and digital transformation on competitive outcomes.

The Indonesian technology startup ecosystem provides an important empirical setting for examining these relationships, particularly in Bandung. Indonesia's rapid expansion of digital entrepreneurship has been accompanied by increasing digital consumption, financial technology, electronic commerce, and technology-based services, while startups simultaneously face technological disruption, funding constraints, changing investor expectations, and increasingly intense competition [17], [18]. Bandung represents a particularly relevant setting due to its established reputation in education, technology, creative industries, and entrepreneurship, supported by universities, technology-oriented human capital, entrepreneurial communities, incubators, and creative industry networks. Nevertheless, startups in Bandung increasingly compete not only with local firms but also with businesses from other major Indonesian cities and global digital platforms [3], [19]. Despite the importance of this context, previous studies have frequently examined strategic agility, digital transformation, innovation capability, and competitive advantage separately, concentrated on established firms or SMEs in general, and provided limited examination of innovation capability as a mediating mechanism. This fragmentation leaves an important research gap concerning how strategic and digital capabilities interact and are converted into competitive advantage specifically within technology startups.

Accordingly, this study aims to analyze the effects of strategic agility and digital transformation on innovation capability and competitive advantage among technology startups in Bandung. Specifically, it examines the effects of strategic agility and digital transformation on innovation capability and competitive advantage, the effect of innovation capability on competitive advantage, and the mediating role of innovation capability in the relationships

between strategic agility and competitive advantage and between digital transformation and competitive advantage. Theoretically, this study contributes by integrating the Resource-Based View and Dynamic Capabilities Theory into a unified framework that explains how strategic responsiveness and digital resources are converted into innovation and competitive outcomes in technology startups. Practically, the findings are expected to provide insights for startup founders and managers regarding the importance of integrating strategic agility, digital transformation, and innovation capability rather than relying solely on technological investment. The results may also inform policymakers, universities, incubators, accelerators, and investors in designing initiatives that strengthen the long-term competitiveness of technology startups within Bandung's evolving digital ecosystem.

2. LITERATURE REVIEW

2.1 *Resource-Based View*

The Resource-Based View (RBV) explains competitive advantage through differences in firms' resources and capabilities. According to [15], resources can generate sustained competitive advantage when they are valuable, rare, imperfectly imitable, and non-substitutable. In technology startups, this perspective is particularly relevant because competitiveness depends largely on intangible capabilities rather than physical assets. Within this study, strategic agility reflects the ability to deploy and reallocate resources in response to environmental change, digital transformation represents the strategic integration of digital resources into organizational activities, and innovation capability enables firms to recombine these resources into new products, services,

processes, and business models [20], [21]. Thus, the RBV provides a theoretical basis for explaining how these organizational capabilities can create distinctive resource configurations and strengthen the competitive advantage of technology startups.

2.2 *Dynamic Capabilities Theory*

Dynamic Capabilities Theory extends the RBV by explaining how firms continuously integrate, renew, and reconfigure resources in rapidly changing environments. [16] conceptualizes these capabilities through sensing, seizing, and transforming, which enable firms to identify opportunities, mobilize resources, and adapt organizational structures. In this study, strategic agility supports rapid responses to environmental change, digital transformation facilitates the integration of emerging technologies, and innovation capability enables firms to recombine resources into new value. Thus, Dynamic Capabilities Theory explains how technology startups continuously adapt their strategic and technological resources to strengthen innovation and sustain competitive advantage.

2.3 *Strategic Agility*

Strategic agility refers to an organization's ability to rapidly recognize environmental changes, formulate strategic responses, and flexibly mobilize resources. [5], [6] conceptualize strategic agility through three dimensions: strategic sensitivity, leadership unity, and resource fluidity. Strategic sensitivity enables firms to identify technological and market

changes, leadership unity supports timely and coordinated decision-making, while resource fluidity allows resources to be reallocated toward emerging opportunities [22], [23]. Unlike operational flexibility, strategic agility involves broader adjustments to strategies, business models, markets, and resource configurations. In this study, strategic agility is viewed as a key organizational capability that enables technology startups to respond effectively to uncertainty, support innovation, and strengthen competitive advantage.

2.4 *Digital Transformation*

Digital transformation refers to the strategic integration of digital technologies into organizational processes, customer relationships, business models, and value creation mechanisms [24]–[26]. Unlike digitization or digitalization, digital transformation involves broader organizational change that reshapes how firms operate and compete. For technology startups, it may include the use of cloud computing, artificial intelligence, data analytics, automation, and digital platforms to improve connectivity, scalability, decision-making, and experimentation. However, digital transformation does not automatically create competitive advantage because its effectiveness depends on how well digital resources are integrated with organizational strategy and capabilities [27], [28]. In this study, digital transformation is therefore viewed as a strategic capability that supports innovation and

enables startups to convert digital resources into superior value.

2.5 *Innovation Capability*

Innovation capability refers to an organization's ability to continuously generate, develop, implement, and commercialize new ideas into products, services, processes, technologies, or business models. [29], [30] define it as the capability to transform knowledge and ideas into innovations that create value for the firm and its stakeholders. For technology startups, innovation capability is particularly important because differentiation often depends on the ability to identify customer needs, exploit technological opportunities, experiment with new solutions, and integrate knowledge with existing resources [31], [32]. In this study, innovation capability is positioned as both an outcome of strategic agility and digital transformation and an antecedent of competitive advantage, reflecting its role in converting strategic responsiveness and digital resources into commercially valuable innovations.

2.6 *Competitive Advantage*

Competitive advantage refers to a firm's ability to create superior value and establish a stronger market position than competitors. [33], [34] links competitive advantage to cost efficiency, differentiation, and strategic positioning, while [15] emphasizes value-creating strategies that competitors cannot easily replicate. For technology startups, competitive advantage may arise from product differentiation, technological uniqueness,

superior customer experience, operational efficiency, faster innovation, scalable business models, and rapid market responsiveness. Because digital markets change quickly, competitive advantage must be continuously renewed [35], [36]. In this study, competitive advantage is therefore viewed as the ability of technology startups to create distinctive value, respond effectively to market changes, and maintain a favorable competitive position through strategic agility, digital transformation, and innovation capability.

2.7 *Hypothesis Development*

Strategic agility and digital transformation are expected to strengthen innovation capability in technology startups. Strategic agility enables firms to identify technological trends, customer needs, and market opportunities through strategic sensitivity, while leadership unity supports rapid decision-making and resource fluidity allows financial, human, and technological resources to be redirected toward promising innovation activities. These mechanisms align with Dynamic Capabilities Theory, particularly the processes of sensing, seizing, and transforming resources. Similarly, digital transformation provides technological infrastructure through data analytics, cloud computing, artificial intelligence, digital platforms, and collaboration systems that improve connectivity, knowledge integration, experimentation, customer insight, and product development speed [7]–[9]. Therefore, strategic agility and digital transformation are

expected to positively influence innovation capability.

Strategic agility, digital transformation, and innovation capability are also expected to strengthen competitive advantage. Strategic agility allows startups to respond quickly to competitive threats, modify strategic priorities, reallocate resources, and exploit emerging market opportunities, while digital transformation enhances operational efficiency, scalability, customer engagement, and strategic decision-making. From the Resource-Based View, their competitive value lies in firm-specific combinations of knowledge, routines, managerial processes, and technological capabilities that are difficult to imitate. Innovation capability further supports competitive advantage by enabling firms to continuously develop new products, improve processes, redesign business models, and create distinctive customer value [34], [37], [38]. Consequently, startups that effectively integrate these capabilities are more likely to achieve stronger competitive positions.

H1: Strategic agility has a positive and significant effect on innovation capability.

H2: Digital transformation has a positive and significant effect on innovation capability.

H3: Strategic agility has a positive and significant effect on competitive advantage.

H4: Digital transformation has a positive and significant effect on competitive advantage.

H5: Innovation capability has a positive and significant effect on competitive advantage.

Strategic agility and digital transformation may influence competitive advantage indirectly through innovation capability. Strategic agility enables startups to identify opportunities, make rapid decisions, and mobilize resources, while innovation capability converts these strategic responses into new products, services, processes, or business models that create market value [37], [38]. Similarly, digital transformation provides technological resources, data, connectivity, and organizational infrastructure, but these resources may not generate sustainable differentiation unless they are transformed into meaningful innovations. Innovation capability therefore serves as a conversion mechanism that translates strategic responsiveness and digital resources into differentiation, customer value, operational effectiveness, and market responsiveness [39], [40]. From the perspectives of Dynamic Capabilities Theory and the Resource-Based View, innovation capability can thus mediate the relationships between strategic agility and competitive advantage as well as between digital transformation and competitive advantage.

H6: Innovation capability positively and significantly mediates the relationship between strategic agility and competitive advantage.

H7: Innovation capability positively and significantly mediates the relationship between digital transformation and competitive advantage.

3. METHODS

3.1 Research Design

This study employed a quantitative explanatory design to examine the relationships among Strategic Agility, Digital Transformation, Innovation Capability, and Competitive Advantage in technology startups in Bandung, Indonesia. Data were collected through a cross-sectional survey to obtain standardized measurements of respondents' perceptions of the study variables. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 3 because the model involved multiple latent constructs as well as direct and indirect relationships. The analysis consisted of two main stages: evaluation of the measurement model and evaluation of the structural model.

3.2 Research Location and Object

The study was conducted in Bandung, West Java, Indonesia, focusing on technology startups operating in technology-based sectors such as software development, digital platforms, financial technology, education technology, e-commerce, digital marketing, business solutions, and creative technology. Bandung was selected because it is recognized as an important center for technology, creative industries, entrepreneurship, and digital business development in Indonesia. The unit of analysis was individual respondents who possessed sufficient knowledge of the strategic, technological, innovation, and competitive activities of the startups in which they worked.

3.3 Population and Sample

The population comprised individuals involved in technology startups operating in Bandung, including founders, co-founders, managers, supervisors, team leaders, and employees with sufficient knowledge of organizational activities. The final sample consisted of 190 respondents selected through purposive sampling based on specific criteria: being at least 18 years old, working in a Bandung-based technology startup, understanding the organization's strategic and operational activities, having experience with digital technology and

innovation activities, and participating voluntarily. This sampling technique was considered appropriate because the study required respondents with relevant organizational knowledge to provide reliable information regarding strategic agility, digital transformation, innovation capability, and competitive advantage.

3.4 Data Sources

This study primarily used primary data collected directly from respondents through a structured questionnaire, while secondary data were used to support the theoretical framework and hypothesis development. The secondary data were obtained from scientific journals, academic books, previous empirical studies, and other relevant scholarly sources concerning Strategic Agility, Digital Transformation, Innovation Capability, Competitive Advantage, the Resource-Based View, and Dynamic Capabilities Theory.

3.5 Data Collection Technique

Data were collected through a structured questionnaire distributed directly and online to eligible respondents from technology startups in Bandung. Respondents were informed about the research purpose, academic use of the data, and voluntary nature of participation, and were asked to respond based on their actual organizational experience. All responses were reviewed for completeness and consistency, and only valid questionnaires were included in the final dataset of 190 respondents.

3.6 Research Instrument

The research instrument was a structured questionnaire consisting of two sections: respondent characteristics and measurement items for the four research variables. Respondent characteristics included gender, age, educational background, organizational position, length of involvement in the startup, and business sector. All construct items were measured using a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. This scale was selected because it is simple,

easy to understand, and provides sufficient response variation, with higher scores indicating stronger agreement with the statements representing each construct.

3.7 Operational Definition of Variables

The research model comprised four latent variables: Strategic Agility, Digital Transformation, Innovation Capability, and Competitive Advantage. Strategic Agility and Digital Transformation were treated as exogenous variables, Innovation Capability as an endogenous and mediating variable, and Competitive Advantage as the ultimate endogenous variable. Strategic Agility was measured through strategic sensitivity, leadership unity, resource fluidity, speed of strategic response, and strategic flexibility; Digital Transformation through digital technology integration, business process digitalization, data-driven decision-making, digital customer interaction, digital business model development, and organizational readiness for digital change; Innovation Capability through idea generation, product or service development, process improvement, innovation implementation speed, technology adoption, and innovative market responsiveness; and Competitive Advantage through differentiation, superior customer value, market responsiveness, technological superiority, operational efficiency, competitive positioning, and responsiveness to competitive pressure. Higher scores indicated stronger levels of each respective construct.

3.8 Data Analysis Technique

The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 3, covering

descriptive statistics, measurement model evaluation, structural model evaluation [41], hypothesis testing, and mediation analysis. The measurement model was assessed using outer loadings (≥ 0.70), Average Variance Extracted (AVE > 0.50), Cronbach's Alpha and Composite Reliability (≥ 0.70), and discriminant validity using HTMT (< 0.90), supported by the Fornell-Larcker criterion and cross-loadings. The structural model was evaluated through Variance Inflation Factor (VIF < 5.00), coefficient of determination (R^2), effect size (f^2), predictive relevance ($Q^2 > 0$), and path coefficients. Hypotheses were tested using bootstrapping at a 5% significance level, with relationships considered significant when t-statistics exceeded 1.96 and p-values were below 0.05. Mediation analysis was further conducted to examine the indirect effects of Strategic Agility and Digital Transformation on Competitive Advantage through Innovation Capability, with mediation considered significant when $p < 0.05$ and the bootstrap confidence interval did not include zero.

4. RESULTS AND DISCUSSION

4.1 Respondent Characteristics

The data were analyzed using PLS-SEM with SmartPLS 3, including descriptive analysis, measurement model evaluation, structural model evaluation, hypothesis testing, and mediation analysis. The measurement model was assessed using outer loading, AVE, Cronbach's Alpha, Composite Reliability, and HTMT, while the structural model was evaluated using VIF, R^2 , f^2 , Q^2 , and path coefficients. Hypotheses and mediation effects were tested through bootstrapping, with significance determined at $p < 0.05$ and $t > 1.96$.

Table 1. Characteristics of Respondents

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	112	58.9
	Female	78	41.1
Age	18–25 years	48	25.3
	26–35 years	87	45.8
	36–45 years	39	20.5
	>45 years	16	8.4

Education	Senior High School	21	11.1
	Diploma	30	15.8
	Bachelor's Degree	112	58.9
	Postgraduate	27	14.2
Position	Founder/Co-Founder	37	19.5
	Manager	46	24.2
	Supervisor/Team Leader	42	22.1
	Employee	65	34.2
Startup Experience	<1 year	29	15.3
	1–3 years	83	43.7
	4–6 years	54	28.4
	>6 years	24	12.6

The respondent characteristics show that the study involved 190 participants from technology startups in Bandung. Most respondents were male (58.9%), aged 26–35 years (45.8%), and held a bachelor's degree (58.9%). In terms of organizational position, employees represented the largest group (34.2%), followed by managers (24.2%), supervisors/team leaders (22.1%), and founders/co-founders (19.5%). Regarding startup experience, the majority had worked in startups for 1–3 years (43.7%), followed by 4–6 years (28.4%). These characteristics indicate that the respondents were predominantly young, well-educated professionals with sufficient organizational

experience, making them relevant sources of information for evaluating strategic agility, digital transformation, innovation capability, and competitive advantage in technology startups.

4.2 Descriptive Analysis of Research Variables

Descriptive analysis was conducted to identify respondents' general perceptions of the four constructs. Because all indicators were measured using a five-point Likert scale, higher mean values indicate stronger agreement with the statements representing each construct.

Table 2. Descriptive Statistics of Research Variables

Variable	N	Mean	Standard Deviation	Interpretation
Strategic Agility	190	4.18	0.612	High
Digital Transformation	190	4.25	0.587	Very High
Innovation Capability	190	4.16	0.603	High
Competitive Advantage	190	4.21	0.594	Very High

The descriptive statistics show that all research variables were rated at high to very high levels by the 190 respondents. Digital Transformation recorded the highest mean score ($M = 4.25$, $SD = 0.587$), followed by Competitive Advantage ($M = 4.21$, $SD = 0.594$), Strategic Agility ($M = 4.18$, $SD = 0.612$), and Innovation Capability ($M = 4.16$, $SD = 0.603$). These results indicate that technology startups in Bandung generally demonstrate strong digital transformation, strategic agility, innovation capability, and competitive advantage, with digital transformation emerging as the most highly perceived organizational capability.

4.3 Measurement Model Assessment

The measurement model was evaluated through indicator reliability, convergent validity, internal consistency reliability, and discriminant validity. Indicator reliability was examined using outer loadings, while convergent validity was assessed using Average Variance Extracted (AVE). Cronbach's Alpha and Composite Reliability were employed to evaluate internal consistency.

4.4 Outer Loading

Table 3. Outer Loading Results

Construct	Indicator	Outer Loading	Decision
Strategic Agility	SA1	0.812	Valid
	SA2	0.846	Valid
	SA3	0.829	Valid
	SA4	0.861	Valid
	SA5	0.838	Valid
Digital Transformation	DT1	0.824	Valid
	DT2	0.851	Valid
	DT3	0.873	Valid
	DT4	0.842	Valid
	DT5	0.858	Valid
	DT6	0.816	Valid
Innovation Capability	IC1	0.835	Valid
	IC2	0.867	Valid
	IC3	0.821	Valid
	IC4	0.854	Valid
	IC5	0.879	Valid
	IC6	0.843	Valid
Competitive Advantage	CA1	0.818	Valid
	CA2	0.847	Valid
	CA3	0.865	Valid
	CA4	0.839	Valid
	CA5	0.856	Valid
	CA6	0.827	Valid
	CA7	0.871	Valid

The outer loading results show that all indicators for Strategic Agility, Digital Transformation, Innovation Capability, and Competitive Advantage have values above the recommended threshold of 0.70, ranging from 0.812 to 0.879. The highest loading was recorded by IC5 (0.879), while the lowest was SA1 (0.812). Therefore, all indicators are

considered valid and demonstrate adequate indicator reliability, confirming that they appropriately represent their respective latent constructs and can be retained for further analysis.

4.5 Construct Reliability and Convergent Validity

Table 4. Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE	Decision
Strategic Agility	0.894	0.922	0.701	Reliable and Valid
Digital Transformation	0.914	0.933	0.699	Reliable and Valid
Innovation Capability	0.921	0.939	0.723	Reliable and Valid
Competitive Advantage	0.929	0.943	0.714	Reliable and Valid

The reliability and convergent validity results indicate that all constructs meet the recommended criteria. Cronbach's Alpha values range from 0.894 to 0.929 and Composite Reliability values range from 0.922 to 0.943, both exceeding the minimum threshold of 0.70, confirming strong internal consistency. In addition, all AVE values range from 0.699 to 0.723, exceeding the

recommended threshold of 0.50. Therefore, Strategic Agility, Digital Transformation, Innovation Capability, and Competitive Advantage are considered reliable and demonstrate adequate convergent validity.

4.6 Discriminant Validity

Discriminant validity was assessed using the Heterotrait-Monotrait Ratio

(HTMT). Values below 0.90 indicate adequate empirical distinction between constructs.

Table 5. HTMT Results

Construct	SA	DT	IC	CA
Strategic Agility (SA)	—			
Digital Transformation (DT)	0.681	—		
Innovation Capability (IC)	0.746	0.781	—	
Competitive Advantage (CA)	0.721	0.758	0.814	—

The HTMT results show that all construct correlations are below the recommended threshold of 0.90, ranging from 0.681 to 0.814. The highest HTMT value is between Innovation Capability and Competitive Advantage (0.814), while the lowest is between Strategic Agility and Digital Transformation (0.681). These findings

indicate that all constructs are empirically distinct from one another and therefore satisfy the criteria for discriminant validity.

4.7 Multicollinearity Assessment

Before evaluating the structural relationships, multicollinearity was assessed using the Variance Inflation Factor (VIF).

Table 6. Inner VIF Results

Predictor	Endogenous Construct	VIF
Strategic Agility	Innovation Capability	1.864
Digital Transformation	Innovation Capability	1.864
Strategic Agility	Competitive Advantage	2.116
Digital Transformation	Competitive Advantage	2.284
Innovation Capability	Competitive Advantage	2.476

The inner VIF results range from 1.864 to 2.476, which are well below the recommended threshold of 5.00. The highest VIF value is observed for Innovation Capability in predicting Competitive Advantage (2.476), while the lowest values are found for Strategic Agility and Digital Transformation in predicting Innovation Capability (1.864). These results indicate that multicollinearity is not a concern in the structural model, and the predictor constructs can therefore be used reliably for further hypothesis testing.

4.8 Coefficient of Determination

The coefficient of determination results show that Strategic Agility and Digital

Transformation explain 68.4% of the variance in Innovation Capability ($R^2 = 0.684$; Adjusted $R^2 = 0.681$), indicating moderate-to-substantial explanatory power. Meanwhile, Strategic Agility, Digital Transformation, and Innovation Capability jointly explain 75.6% of the variance in Competitive Advantage ($R^2 = 0.756$; Adjusted $R^2 = 0.752$), indicating substantial explanatory power. The remaining variance is explained by factors outside the proposed model.

4.9 Effect Size

The f^2 statistic was evaluated to determine the contribution of individual predictors to their respective endogenous constructs.

Table 7. Effect Size Results

Relationship	f^2	Interpretation
Strategic Agility → Innovation Capability	0.241	Medium
Digital Transformation → Innovation Capability	0.318	Medium
Strategic Agility → Competitive Advantage	0.071	Small
Digital Transformation → Competitive Advantage	0.094	Small
Innovation Capability → Competitive Advantage	0.276	Medium

The effect size results indicate that Strategic Agility has a medium effect on Innovation Capability ($f^2 = 0.241$), while Digital Transformation shows a stronger medium effect ($f^2 = 0.318$). For Competitive Advantage, Strategic Agility ($f^2 = 0.071$) and Digital Transformation ($f^2 = 0.094$) have small effects, whereas Innovation Capability has a medium effect ($f^2 = 0.276$). These findings suggest that Digital Transformation contributes most strongly to Innovation Capability, while Innovation Capability plays a more substantial role in explaining Competitive Advantage than the direct effects of Strategic Agility and Digital Transformation.

4.10 Predictive Relevance

The predictive relevance results show that both endogenous variables have Q^2 values above zero, with Innovation Capability recording $Q^2 = 0.472$ and Competitive Advantage $Q^2 = 0.531$. These values indicate that the structural model has strong predictive relevance for both constructs, with Competitive Advantage showing slightly higher predictive capability.

4.11 Direct Effect and Hypothesis Testing

Bootstrapping was used to examine the significance of the structural relationships. Relationships were considered significant when t-statistics exceeded 1.96 and p-values were below 0.05.

Table 8. Direct Effect Hypothesis Testing

Hypothesis	Relationship	β	STDEV	t-statistic	p-value	Decision
H1	SA $\rightarrow$ IC	0.382	0.057	6.702	<0.001	Supported
H2	DT $\rightarrow$ IC	0.497	0.055	9.036	<0.001	Supported
H3	SA $\rightarrow$ CA	0.194	0.061	3.180	0.002	Supported
H4	DT $\rightarrow$ CA	0.231	0.064	3.609	<0.001	Supported
H5	IC $\rightarrow$ CA	0.468	0.058	8.069	<0.001	Supported

The direct effect results show that all proposed hypotheses are supported. Strategic Agility has a positive and significant effect on Innovation Capability ($\beta = 0.382$, $t = 6.702$, $p < 0.001$), while Digital Transformation has an even stronger effect on Innovation Capability ($\beta = 0.497$, $t = 9.036$, $p < 0.001$). Strategic Agility ($\beta = 0.194$, $t = 3.180$, $p = 0.002$) and Digital Transformation ($\beta = 0.231$, $t = 3.609$, $p < 0.001$) also significantly enhance Competitive Advantage. The strongest direct effect on Competitive Advantage is generated by

Innovation Capability ($\beta = 0.468$, $t = 8.069$, $p < 0.001$), indicating that innovation capability is a key determinant of competitive advantage among technology startups.

4.12 Indirect Effects and Mediation Analysis

The specific indirect effects were examined to determine whether Innovation Capability mediated the effects of Strategic Agility and Digital Transformation on Competitive Advantage.

Table 9. Specific Indirect Effects

Hypothesis	Indirect Relationship	β	STDEV	t-statistic	p-value	Decision
H6	SA $\rightarrow$ IC $\rightarrow$ CA	0.179	0.035	5.114	<0.001	Supported
H7	DT $\rightarrow$ IC $\rightarrow$ CA	0.233	0.039	5.974	<0.001	Supported

The specific indirect effect results show that Innovation Capability significantly mediates the effects of both Strategic Agility and Digital Transformation on Competitive Advantage. Strategic Agility has a positive and significant indirect effect on Competitive

Advantage through Innovation Capability ($\beta = 0.179$, $t = 5.114$, $p < 0.001$), supporting H6. Likewise, Digital Transformation has a positive and significant indirect effect on Competitive Advantage through Innovation Capability ($\beta = 0.233$, $t = 5.974$, $p < 0.001$),

supporting H7. These findings confirm that Innovation Capability serves as an important mediating mechanism linking strategic and digital capabilities to stronger competitive advantage.

4.13 Total Effects

Table 10. Total Effects on Competitive Advantage

Relationship	Direct Effect	Indirect Effect	Total Effect
SA → CA	0.194	0.179	0.373
DT → CA	0.231	0.233	0.464
IC → CA	0.468	—	0.468

The total effect results show that Innovation Capability has the strongest overall effect on Competitive Advantage ($\beta = 0.468$), followed closely by Digital Transformation (total effect = 0.464) and Strategic Agility (total effect = 0.373). Digital Transformation influences Competitive Advantage both directly ($\beta = 0.231$) and indirectly through Innovation Capability ($\beta = 0.233$), while Strategic Agility also has direct ($\beta = 0.194$) and indirect effects ($\beta = 0.179$). These results indicate that Innovation Capability is the most important immediate determinant of Competitive Advantage and also strengthens the effects of Strategic Agility and Digital Transformation on startup competitiveness.

Discussion

The findings show that Strategic Agility has a positive and significant effect on Innovation Capability, indicating that technology startups with stronger abilities to recognize environmental changes, make rapid strategic decisions, and flexibly reallocate resources tend to demonstrate greater innovation capability. This result is consistent with Dynamic Capabilities Theory, particularly the processes of sensing, seizing, and transforming resources. Strategic sensitivity helps startups identify technological trends and market opportunities, leadership unity accelerates innovation-related decisions, and resource fluidity enables the reallocation of financial, human, and technological resources toward promising projects [7], [8], [10]. Thus, Strategic Agility functions not only as a

The total effects provide a broader assessment of the contribution of Strategic Agility and Digital Transformation to Competitive Advantage by combining their direct and indirect effects.

mechanism for adaptation but also as an important driver of innovation in dynamic startup environments.

Digital Transformation also has a positive and significant effect on Innovation Capability and shows a stronger coefficient than Strategic Agility. This finding suggests that the strategic integration of digital technologies provides an important foundation for innovation by improving information access, collaboration, experimentation, customer analysis, and product development. Digital technologies such as data analytics, cloud systems, digital platforms, and collaborative tools can shorten development cycles and help startups transform information into innovative solutions [5], [6], [42]. Therefore, Digital Transformation should be understood not merely as technology adoption, but as an organizational transformation that strengthens the capacity for continuous innovation.

Strategic Agility and Digital Transformation also significantly influence Competitive Advantage, although their direct effects are smaller than the effect of Innovation Capability. Strategic Agility strengthens competitiveness by enabling faster responses to market changes, customer needs, technological developments, and competitive threats, while Digital Transformation improves efficiency, customer connectivity, scalability, and decision-making. From the Resource-Based View, these capabilities create stronger competitive value when they are embedded in firm-specific routines, knowledge, leadership

processes, and organizational configurations that are difficult for competitors to imitate [24], [25], [43]. The smaller direct coefficients indicate that strategic responsiveness and digital resources alone are not sufficient unless they are transformed into tangible value-creating outcomes.

Innovation Capability has the strongest direct effect on Competitive Advantage, confirming its central role in startup competitiveness. Startups with stronger innovation capabilities are better able to develop new products and services, improve processes, adopt technologies, respond to customer needs, and create differentiated market value. Innovation Capability also significantly mediates the effects of both Strategic Agility and Digital Transformation on Competitive Advantage, with both relationships showing complementary partial mediation. This means that Strategic Agility and Digital Transformation influence competitiveness both directly and indirectly by strengthening Innovation Capability [29], [30], [44]. The mediation findings support the argument that competitive value emerges when strategic responsiveness and digital resources are converted into commercially relevant innovations.

Overall, the structural model demonstrates strong explanatory power, with Strategic Agility and Digital Transformation explaining 68.4% of the variance in Innovation Capability, while Strategic Agility, Digital Transformation, and Innovation Capability explain 75.6% of the variance in Competitive Advantage. Digital Transformation has the strongest total effect among the exogenous variables, while Innovation Capability remains the strongest direct predictor of Competitive Advantage. These findings support the integration of the Resource-Based View and Dynamic Capabilities Theory by

showing that competitive advantage among technology startups emerges from the interaction of strategic responsiveness, digital transformation, and continuous innovation. Consequently, startup managers and ecosystem actors should develop these capabilities in an integrated manner rather than treating them independently.

5. CONCLUSION

This study concludes that Strategic Agility and Digital Transformation significantly strengthen Innovation Capability and Competitive Advantage among technology startups in Bandung. Strategic Agility enhances startups' ability to respond to environmental changes, make rapid decisions, and reallocate resources, while Digital Transformation improves innovation through the strategic integration of digital technologies. Innovation Capability emerged as the strongest direct predictor of Competitive Advantage and significantly mediated the effects of both Strategic Agility and Digital Transformation, indicating that these capabilities create greater competitive value when translated into innovation. The model explained 68.4% of the variance in Innovation Capability and 75.6% of the variance in Competitive Advantage, demonstrating substantial explanatory power. The findings support the integration of the Resource-Based View and Dynamic Capabilities Theory and suggest that startups should simultaneously strengthen strategic responsiveness, digital integration, and continuous innovation. However, the study is limited by its cross-sectional design and focus on Bandung; future research should consider broader geographical coverage, longitudinal designs, sectoral comparisons, and additional organizational capabilities.

REFERENCES

- [1] A. Hameli, I. Kampouris, A. K. Machaal, and ..., "Financial development, institutions, gender and entrepreneurship in the United Arab Emirates," *Asian Journal of academia.edu*, 2021.

- [2] L. Grassi, N. Figini, and L. Fedeli, "How does a data strategy enable customer value? The case of FinTechs and traditional banks under the open finance framework," *Financial Innovation*. jfin-swufe.springeropen.com, 2022. doi: 10.1186/s40854-022-00378-x.
- [3] R. Stevy, I. Puspa, D. Widjaja, and R. Ongsa, "Analysis of Internal Factors for Improving the Performance of Startup Companies in Medan, Indonesia," *J. Madani Soc.*, vol. 2, no. 1, pp. 67–74, 2023.
- [4] S. Jones and R. Masters, "Entrepreneurship in emerging and developing markets: the case of Vietnam," *Eff. Exec.*, 2016.
- [5] R. Cannas, "Exploring digital transformation and dynamic capabilities in agrifood SMEs," *J. Small Bus. Manag.*, 2023, doi: 10.1080/00472778.2020.1844494.
- [6] A. Ghezzi and A. Cavallo, "Agile business model innovation in digital entrepreneurship: Lean startup approaches," *J. Bus. Res.*, 2020.
- [7] J. I. C. Goni and A. Van Looy, "Process innovation capability in less-structured business processes: a systematic literature review," *Bus. Process Manag. J.*, vol. 28, no. 3, pp. 557–584, Jan. 2022, doi: 10.1108/BPMJ-07-2021-0487.
- [8] G. Tortorella, M. Gloet, D. Samson, S. Kurnia, F. S. Fogliatto, and M. J. Anzanello, "Food supply chain resilience through digital transformation: a mixed-method approach," *Int. J. Logist. Manag.*, 2024, doi: 10.1108/IJLM-01-2024-0030.
- [9] N. Alkhamery, F. A. Zainol, and M. Al-Nashmi, "The role of dynamic capabilities in reconfiguring operational capabilities for digital business transformation," *J. Manag. Theory Pract.*, pp. 1–8, 2021.
- [10] S. Cheng, Q. Fan, and M. Huang, "Strategic orientation, dynamic capabilities, and digital transformation of commercial banks: a fuzzy-set QCA approach," *Sustainability*, 2023.
- [11] R. Silvi, C. Nielsen, and A. Pia, "From Insights to Business Model Innovation and Results: Using the Digital Transformation Canvas," *J. Bus. Model.*, 2023.
- [12] V. B. Klein and J. L. Todesco, "COVID-19 crisis and SMEs responses: The role of digital transformation," *Knowl. Process Manag.*, 2021, doi: 10.1002/kpm.1660.
- [13] F. Brunetti, D. T. Matt, A. Bonfanti, A. De Longhi, and ..., "Digital transformation challenges: strategies emerging from a multi-stakeholder approach," *The TQM emerald.com*, 2020. doi: 10.1108/TQM-12-2019-0309.
- [14] G. Vial, "Understanding digital transformation," *Manag. Digit. Transform.*, pp. 13–66, 2021, doi: 10.4324/9781003008637-4.
- [15] J. Barney, "Firm resources and sustained competitive advantage," *J. Manage.*, vol. 17, no. 1, pp. 99–120, 1991.
- [16] D. J. Teece, "Dynamic capabilities: Routines versus entrepreneurial action," *J. Manag. Stud.*, vol. 49, no. 8, pp. 1395–1401, 2012.
- [17] J. R. Coyanda, "Model Technopreneur IT Mahasiswa Pada Masa Pandemi Covid 19 dengan Metode Business Model Canvas," *J. Ilm. Inform. Glob.*, vol. 11, no. 1, pp. 27–32, 2020, doi: 10.36982/jig.v11i1.1069.
- [18] H. W. Aripudono, "COMPETITIVE ADVANTAGE USING A RESOURCE-BASED VIEW STARTUP EDUCATION TECHNOLOGY IN INDONESIA," in *Proceeding of The International Seminar on Business, Economics, Social Science and Technology (ISBEST)*, 2022.
- [19] R. Setiawan, A. Eliyana, T. Suryani, and D. Liaw, "Promoting employee creativity: The practices of transformational leadership, knowledge sharing, and task conflict behaviour on start-up business in Indonesia," *Syst. Rev. Pharm.*, vol. 11, no. 12, pp. 1272–1282, 2020, doi: 10.31838/srp.2020.12.187.
- [20] T. P. T. Nguyen, F. Huang, and X. Tian, "Intellectual property protection need as a driver for open innovation: Empirical evidence from Vietnam," *Technovation*, vol. 123, p. 102714, 2023, doi: <https://doi.org/10.1016/j.technovation.2023.102714>.
- [21] A. Hussain, S. A. Ahmad, S. Mia, F. Ahmed, and P. Prommee, "Relationship between business information, business networking, access to finance and financial performance of social enterprises: Perspective of resource-based view and signalling theory," *Cogent Bus. Manag.*, vol. 11, no. 1, 2023, doi: 10.1080/23311975.2023.2285062.
- [22] H. A. Rozak, A. Adhiatma, O. Fachrunnisa, and T. Rahayu, "Social media engagement, organizational agility and digitalization strategic plan to improve SMEs' performance," *IEEE Trans. Eng. Manag.*, 2021.
- [23] A. Pinsonneault and I. Choi, "Digital-enabled strategic agility: it's time we examine the sensing of weak signals," *Eur. J. Inf. Syst.*, 2022, doi: 10.1080/0960085X.2022.2027824.
- [24] G. C. Unruh, "From Geomimetic to Biomimetic Manufacturing: Digitally Transforming Industry for Sustainability," *Sustain.*, vol. 15, no. 5, 2023, doi: 10.3390/su15054550.
- [25] L. Cavalli, G. Lizzi, L. Guerrieri, A. Querci, F. De Bari, and ..., "Addressing efficiency and sustainability

- in the port of the future with 5G: The experience of the livorno port. a methodological insight to measure innovation ...," *Sustainability*. mdpi.com, 2021.
- [26] J. E. Frick, V. H. J. Fremont, L. J. Åge, and ..., "Digitalization efforts in liminal space–inter-organizational challenges," *J. Bus. ...*, 2020, doi: 10.1108/JBIM-12-2018-0392.
 - [27] M. Wollschlaeger, T. Sauter, and ..., "The future of industrial communication: Automation networks in the era of the internet of things and industry 4.0," *IEEE Ind. ...*, 2017.
 - [28] D. A. Panduru and C. Scarlat, "Digitalization and Strategic Changes in Romanian Retail Fuel Networks: A Qualitative Study," *Information*, 2022.
 - [29] G. Zhao, M. Vazquez-Noguerol, S. Liu, and J. C. Prado-Prado, "Agri-food supply chain resilience strategies for preparing, responding, recovering, and adapting in relation to unexpected crisis: A cross-country comparative analysis from the COVID-19 pandemic," *J. Bus. Logist.*, vol. 45, no. 1, 2024, doi: 10.1111/jbl.12361.
 - [30] I. M. Parsa, T. C. Wijayanti, I. A. N. Yulastuti, I. G. P. Kawiana, and P. Ly, "Technology Adoption and Competence in Improving Teacher Performance," *Int. J. Early Child. Spec. Educ.*, vol. 14, no. 1, pp. 1080–1088, 2022, doi: 10.9756/int-jecse/v14i1.221122.
 - [31] C. Cooper, *Are innovation studies on industrialized economies relevant to technology policy in developing countries?* archive.unu.edu, 1991.
 - [32] N. Yodchai, P. T. M. Ly, and L. T. T. Tran, "How the creative mindset affects entrepreneurial success in the tourism sector: the mediating role of innovation capability," *Int. J. Contemp. Hosp. Manag.*, vol. 34, no. 1, pp. 279–298, 2022.
 - [33] R. H. Binsaeed, Z. Yousaf, A. Grigorescu, A. Samoila, R. I. Chitescu, and A. A. Nassani, "Knowledge Sharing Key Issue for Digital Technology and Artificial Intelligence Adoption," *Systems*, vol. 11, no. 7, 2023. doi: 10.3390/systems11070316.
 - [34] H. Hermansyah, M. Tukiran, E. Herlina, and M. T. Andrianto, "A Review of Strategic Human Resources Management in Organization," *Budapest Int. Res. Critics Inst. Humanit. Soc. Sci.*, vol. 5, no. 2, pp. 14422–14429, 2022.
 - [35] N. Van Doorn and A. Badger, "Platform capitalism's hidden abode: producing data assets in the gig economy," *Antipode*, 2020, doi: 10.1111/anti.12641.
 - [36] T. D. Bui, H. Aminah, C. H. Wang, M. L. Tseng, M. Iranmanesh, and M. K. Lim, "Developing a Food and Beverage Corporate Sustainability Performance Structure in Indonesia: Enhancing the Leadership Role and Tenet Value from an Ethical Perspective," *Sustain.*, vol. 14, no. 6, Mar. 2022, doi: 10.3390/su14063658.
 - [37] Y. M. Basri, G. Gusnardi, D. N. Tassanee, D. P. H. Indraprasta, R. N. Sari, and V. Ratnawati, "Social innovation and financial performance of social enterprises: the mediating role of social and environmental performance," *Cogent Bus. Manag.*, vol. 12, no. 1, p., 2025, doi: 10.1080/23311975.2025.2551283.
 - [38] T. Pucci, E. Casprini, L. Zanni, and ..., "Profiting from the digital integration of the value chain and digital competencies: does open innovation matter for manufacturing SMEs?," ... *Strateg. Manag.*, 2023, doi: 10.1080/09537325.2023.2262054.
 - [39] M. Ratanavanich and P. Charoensukmongkol, "The interaction effect of goal orientation and mindfulness of entrepreneurs on firm innovation capability and its impact on firm performance," *VINE J. Inf. Knowl. Manag. Syst.*, 2024, doi: 10.1108/VJIKMS-06-2023-0135.
 - [40] S. Bacq and K. A. Eddleston, "A resource-based view of social entrepreneurship: How stewardship culture benefits scale of social impact," *J. Bus. Ethics*, vol. 152, pp. 589–611, 2018.
 - [41] J. F. Hair, J. J. Risher, M. Sarstedt, and C. M. Ringle, "When to use and how to report the results of PLS-SEM," *Eur. Bus. Rev.*, vol. 31, no. 1, pp. 2–24, 2019, doi: https://doi.org/10.1108/EBR-11-2018-0203.
 - [42] I. W. E. Arsawan, N. K. ssy De Hariyanti, I. M. A. D. S. Atmaja, D. Suhartanto, and V. Koval, "Developing organizational agility in SMEs: An investigation of innovation's roles and strategic flexibility," *J. Open Innov. Technol. Mark. Complex.*, vol. 8, no. 3, p. 149, 2022.
 - [43] A. De Carolis, M. Macchi, E. Negri, and ..., "Guiding manufacturing companies towards digitalization a methodology for supporting manufacturing companies in defining their digitalization roadmap," ... *Innov. (ICE ...)*, 2017.
 - [44] M. Yertas, A. Ansar, G. Gunawan, and K. Kurniawaty, "The Role of Competitive Advantage as a Mediator of the Influence of Financial Aspects, Human Capital, and Innovation Capability on the Business Performance of SMEs (Empirical Study of SMEs in Manokwari Regency)," *Devot. J. Res. Community Serv.*, vol. 5, no. 1, pp. 140–155, 2024.