

# **Generative AI Integration in the Startup Ecosystem: A Technopreneurship Strategy to Increase Global Competitiveness**

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## **Abstract**

The rapid development of Generative Artificial Intelligence (Generative AI) technology has driven significant transformations in the global startup ecosystem. This technology enables the automation of creative processes, faster data analysis, and more efficient digital product development. In the context of technopreneurship, the integration of generative AI is a strategic factor that can increase startups' innovation capacity while strengthening global competitiveness. However, understanding how the integration of generative AI technology can be optimized in technopreneurship strategies to improve startup competitiveness still requires more in-depth empirical studies. This study aims to analyze the influence of generative AI integration in the startup ecosystem on technopreneurship strategies and its impact on increasing startups' global competitiveness. This study uses a quantitative approach with an explanatory research method. Data were collected through a survey of founders and managers of technology-based startups that utilize digital innovation in their business activities. The sampling technique used purposive sampling with a total of 150 startups as respondents. Data analysis was conducted using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method to test the relationship between the research variables. The results of the study indicate that the integration of generative AI has a positive and significant impact on technopreneurship strategies and startups' global competitiveness. Furthermore, technopreneurship strategies are proven to act as a mediating factor, strengthening the relationship between the use of generative AI technology and increased startup competitiveness in the global market. These findings suggest that the use of generative AI, supported by innovative technological entrepreneurship strategies, can be a source of competitive advantage for startups in facing the dynamics of the global digital economy.

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**Keywords:** generative ai; technopreneurship; startup ecosystem; digital innovation; global competitiveness.

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## INTRODUCTION

The development of digital technology over the past two decades has driven a major transformation in technology-based entrepreneurial activities, or technopreneurship (Akmal, 2025; Rumangkit et al., 2025; Sushant et al., 2025; Wibowo et al., 2022; Wibowo & Sulartopo, 2022). The emergence of Generative Artificial Intelligence (GenAI) is one of the most disruptive technological innovations, capable of transforming business models, innovation processes, and the dynamics of global competition across various industrial sectors. This technology enables computer systems to automatically generate new content such as text, images, program code, and product designs, thereby accelerating the innovation process and digital business development (Aithal, 2023). Therefore, the integration of GenAI technology into the startup ecosystem is a crucial factor in enhancing the innovation capabilities and competitiveness of startups globally (Kusetogullari & others, 2025; McKinsey & Company, 2022; Singh et al., 2024).

A specific phenomenon that highlights this transformation is the emergence of AI-driven startups that are capable of scaling rapidly with relatively limited resources. Unlike traditional startups, these organizations leverage generative AI to automate creative processes, enhance decision-making, and accelerate product development cycles. This phenomenon creates a new paradigm in the startup ecosystem, where competitive advantage is increasingly determined by the ability to integrate advanced technologies into business strategies. However, despite the rapid adoption of GenAI, many startups still face challenges in aligning technological capabilities with effective technopreneurship strategies, leading to suboptimal utilization of AI potential.

The development of GenAI adoption has also shown very rapid growth in recent years. Global surveys show that the use of AI in organizations has increased significantly from 55% in 2023 to around 78% in 2024, while the use of generative AI in business functions has increased from 33% to 71% over the same period. This increase indicates that GenAI technology is no longer merely an experiment, but has become a critical component of modern companies' digital transformation strategies. This condition makes this technology a key driver of innovation and operational efficiency in various organizations, including technology startups (Capgemini Research Institute, 2024; McKinsey & Company, 2024; Stanford Human-Centered Artificial Intelligence, 2025.)

Furthermore, the development of global investment in AI technology also shows a very significant trend. By 2024, global investment in the AI sector will reach more than US\$252 billion, with generative AI funding reaching approximately US\$33.9 billion, a more than eightfold increase compared to 2022. Even by 2025, the AI sector will succeed in attracting nearly 50% of all global venture capital funding, indicating the strong investor interest in AI-based startups. This

phenomenon indicates that AI integration has become a strategic factor in the development of the global startup ecosystem (Stanford Human-Centered Artificial Intelligence, 2025).

**Table 1.** Supporting Data for Global Generative AI Development

Indicator	Global Data
Global generative AI market value (2024)	> US\$130 billion
Global AI investment (2024)	US\$252.3 billion
Adoption of generative AI in organizations	71% of companies
Number of global AI companies	>70,000 companies

Sources: Stanford AI Index, McKinsey Global Survey, HubSpot AI Statistics, Berg Insight

The data shows that generative AI technology is developing rapidly and is becoming a key driver of innovation in the global startup ecosystem. Currently, there are more than 70,000 AI companies worldwide working to develop various artificial intelligence-based solutions to increase productivity and create new business value. Furthermore, the global generative AI market value has exceeded US\$130 billion by 2024, demonstrating the enormous economic potential for technology companies that are able to leverage it strategically (HubSpot, 2025; Berg Insight, 2025; IoT Analytics, 2025).

In the context of technology entrepreneurship, generative AI also acts as a technological enabler that can lower innovation costs and accelerate the process of creating new startups. Recent research shows that GenAI technology can increase the efficiency of the ideation process, accelerate product development, and expand access to knowledge and digital resources for entrepreneurs. This has led to the emergence of a leaner startup model with smaller resource requirements but higher innovation potential (Gindert & Müller, 2024; Cai et al., 2025; Judijanto, 2026).

Several previous studies have discussed the role of artificial intelligence in digital entrepreneurship and the startup ecosystem. Several studies have shown that AI technology can improve innovation performance, operational efficiency, and a company's ability to create new data-driven business models. Furthermore, AI integration also contributes to improved startup performance by strengthening product innovation processes, digital marketing strategies, and more accurate customer data analysis (Singh et al., 2024).

However, most previous research has focused on the general application of artificial intelligence in digital business or technological innovation. Studies specifically examining the role of generative AI in the technopreneurship ecosystem and strategies for enhancing startups' global competitiveness are still relatively limited. Furthermore, research that simultaneously integrates the perspectives of the startup ecosystem, technopreneurship strategies, and the use of generative AI is still rare in the academic literature (Kusetogullari & others, 2025; McKinsey & Company, 2022).

Based on these conditions, a research gap exists that indicates the need for further research on how generative AI can be strategically integrated into the startup ecosystem to enhance innovation and global competitiveness. Many organizations still face challenges in implementing AI effectively, ranging from strategic limitations, technological readiness, to integration into business models. Without an appropriate technopreneurship strategy, the potential of AI technology will not be able to generate sustainable competitive advantage.

Therefore, this research offers novelty in the form of developing a conceptual framework for the integration of generative AI in the startup ecosystem, viewed from the perspective of technopreneurship and global competitiveness. This research not only analyzes the role of AI technology as an innovation tool but also examines how this technology can be strategically utilized to create new business models, enhance ecosystem collaboration, and strengthen startups' position in global competition.

Based on this background, the purpose of this study is to analyze the integration of generative AI in the startup ecosystem as a technopreneurship strategy to increase global competitiveness. This research is expected to provide theoretical contributions to the development of technopreneurship literature and provide practical implications for startups, investors, and policymakers in optimally utilizing generative AI technology in the era of the global digital economy.

The expected contributions of this study are both theoretical and practical. Theoretically, this research contributes to the development of technopreneurship and digital innovation literature by providing empirical evidence on the role of generative AI in shaping entrepreneurial strategies. Practically, this study offers valuable insights for startup founders, investors, and policymakers in designing strategies that optimize the use of generative AI to enhance innovation capacity and global market competitiveness.

Furthermore, the implications of this research extend to policy and strategic decision-making, particularly in supporting the development of AI-driven startup ecosystems. Policymakers can utilize these findings to design supportive regulatory frameworks and innovation policies, while startup practitioners can leverage the results to formulate more adaptive and technology-oriented business strategies. In the broader context, this research highlights the importance of aligning technological innovation with strategic entrepreneurship to ensure sustainable competitiveness in the global digital economy.

## **METHODS**

### **Research Type**

This study uses a quantitative approach with an explanatory research method, which aims to analyze the relationship between generative AI integration, technopreneurship strategy, and startups' global competitiveness (Creswell & Creswell, 2023). The quantitative approach was chosen because this study seeks to empirically test the relationship between variables through

statistical analysis based on survey data. The explanatory research method is used to explain the causal relationship between the studied variables and provide an understanding of how the integration of generative AI technology can influence technopreneurship strategy and increase startups' competitiveness in the global digital ecosystem.

This study also employed a cross-sectional survey design, which involves data collection over a specific time period to illustrate the current state of generative AI technology utilization in technology-based startups. Data analysis was conducted using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach, which allows researchers to simultaneously test complex relationships between multiple latent variables and evaluate the structural and measurement models within the study.

### **Population and Sampling**

The population in this study is technology-based startups that utilize digital technology or artificial intelligence in their business activities. The target population includes founders, co-founders, technology managers, and startup practitioners involved in strategic decision-making related to technological innovation and product development.

The sampling technique used was purposive sampling, which is a technique for determining samples based on specific criteria relevant to the research objectives. The respondent criteria in this study include:

1. Founder or manager of a technology-based startup
2. Startups that have been operating for at least 1 year
3. Startups that utilize digital technology or artificial intelligence in business processes
4. Respondents who understand technology innovation strategies in organizations

The sample size in this study follows the SEM-PLS analysis recommendation, namely a minimum of 100–200 respondents to ensure optimal analysis of the research model. Therefore, this study targeted approximately 150 respondents from various technology startups.

### **Research Instrument**

The research instrument used in this study was a structured questionnaire compiled based on research variable indicators. The questionnaire was structured using a 5-point Likert scale, as follows:

**Table 2.** Research Instrument

Scale	Information
1	Strongly Disagree
2	Don't agree
3	Neutral
4	Agree
5	Strongly agree

Source: Data Processed

The variables measured in this study include:

**Table 3.** Variables Indicator

Variables	Indicator
Generative AI Integration	use of AI in product innovation, business process automation, data analysis, digital service development
Technopreneurship Strategy	technological innovation, digital adaptation, development of technology-based business models
Global Competitiveness of Startups	innovation excellence, global market expansion capabilities, product differentiation

Source: Data Processed

Before use, the research instrument will be tested through validity and reliability tests to ensure that each indicator is able to measure the research variables accurately and consistently.

### Data Collection Technique

The data in this study were obtained from two main sources, namely primary data and secondary data.

1. Primary data was obtained through an online survey distributed to founders, managers, and practitioners of technology-based startups. The questionnaires were distributed through digital survey platforms such as Google Forms or other platforms that allow respondents to provide flexible responses.
2. Secondary data was obtained from various literature sources such as scientific journals, technology industry reports, global startup reports, and publications of international organizations related to the development of generative AI and the startup ecosystem.

Data collection was carried out during the research period by ensuring that participating respondents met the predetermined criteria.

### **Research Procedure**

This research procedure was carried out through several stages as follows:

1. Identify research problems related to the development of generative AI and its impact on the startup ecosystem.
2. Literature study to examine theories related to technopreneurship, artificial intelligence, technological innovation, and global competitiveness.
3. Development of research models and questionnaire instruments based on predetermined variable indicators.
4. Testing of research instruments through initial validity and reliability tests.
5. Data collection through surveys of respondents who meet the research criteria.
6. Data processing and analysis using the SEM-PLS method.
7. Interpretation of research results to explain the relationship between the variables studied.
8. Drawing conclusions and recommendations based on the results of research analysis.

These stages are carried out systematically to ensure that the research process runs in a structured manner and produces valid findings.

### **Data Analysis Technique**

The data analysis technique in this study used Structural Equation Modeling based on Partial Least Squares (SEM-PLS) with the assistance of statistical analysis software such as SmartPLS. The SEM-PLS method was chosen because it is capable of analyzing complex relationships between latent variables and is suitable for use in exploratory research and theoretical model development.

Data analysis is carried out through several main stages, namely:

1. Descriptive analysis, to describe the characteristics of respondents and the distribution of research data.
2. Testing of the measurement model (outer model) which includes tests of convergent validity, discriminant validity, and construct reliability.
3. Testing the structural model (inner model) to see the relationship between variables and test research hypotheses.
4. Testing the coefficient of determination ( $R^2$ ) to determine the ability of the independent variable to explain the dependent variable.
5. Test the significance of the relationship between variables using the bootstrapping method in SEM-PLS.

The results of the analysis are then used to explain the influence of generative AI integration on technopreneurship strategies and its impact on increasing the global competitiveness of startups.

## RESULTS AND DISCUSSION

### Respondent Characteristics and Description of Generative AI Utilization in Startups

Data collection results indicate that the majority of respondents in this study came from technology-based startups operating in the fintech, e-commerce, edtech, and SaaS sectors. Most respondents were founders and technology managers who play strategic roles in digital innovation decision-making within their companies. This respondent composition provides a representative picture of the practice of utilizing generative AI technology in the modern digital startup ecosystem (Capgemini Research Institute, 2024; McKinsey & Company, 2022; Stanford Human-Centered Artificial Intelligence, 2025).

Furthermore, survey results show that most startups have begun integrating generative AI technology into various business activities, such as digital product development, customer data analysis, and customer service automation. The use of AI in startups not only improves operational efficiency but also opens up opportunities for innovative new business models that are more adaptive to global market changes. This demonstrates that generative AI technology plays a key role as a catalyst for digital transformation in the modern startup ecosystem (Singh et al., 2024; Deloitte, 2024; IBM Institute for Business Value, 2024).

The age distribution of the startups surveyed also shows that the majority of companies are in the growth stage, meaning startups have been operating for between 2 and 5 years. In this phase, companies tend to be more proactive in adopting innovative technologies to strengthen their competitiveness and accelerate market expansion. This indicates that the integration of AI technology is becoming a crucial part of startup growth strategies in the global digital ecosystem (OECD, 2024; World Economic Forum, 2024; CB Insights, 2025).

**Table 4.** Respondent Characteristics

Characteristics	Percentage
Founder / Co-Founder	38%
Technology Manager	34%
Product Manager	18%
Startup Analyst	10%

Source: Research Data, 2026

These findings align with global reports showing that technology-based startups are increasingly relying on artificial intelligence to improve innovation efficiency and accelerate digital product development. Furthermore, startups that adopt AI have higher growth potential than those that have not yet integrated the technology. This situation demonstrates that generative AI plays a crucial role in increasing startup competitiveness in the digital economy era (Gartner, 2025; McKinsey & Company, 2022; Stanford Human-Centered Artificial Intelligence, 2025).

**Evaluation of Measurement Model (Outer Model) in SEM-PLS Analysis**

The first stage in SEM-PLS analysis is evaluating the measurement model (outer model) to ensure that each indicator measures the research construct validly and reliably. Testing was conducted through convergent validity, discriminant validity, and composite reliability analyses. The analysis results showed that all indicators had factor loading values above 0.70, indicating a strong relationship with the research variable construct (Hair & Alamer, 2022; Henseler et al., 2023; Sarstedt et al., 2021).

Furthermore, the Average Variance Extracted (AVE) values for all research variables were above the minimum value of 0.50, indicating that the research constructs had good convergent validity. These results indicate that the research indicators were able to adequately explain the latent variables, allowing the research model to proceed to the structural analysis stage. Therefore, the research instrument used in this study can be considered valid for measuring the relationship between generative AI integration, technopreneurship strategy, and startup global competitiveness.

**Table 5.** Results of Convergent Validity Test

<b>Variables</b>	<b>AVE</b>	<b>Information</b>
Generative AI Integration	0.71	Valid
Technopreneurship Strategy	0.74	Valid
Global Competitiveness of Startups	0.76	Valid

Source: SmartPLS Analysis Results, 2026

Reliability testing also showed that all research variables had Composite Reliability and Cronbach's Alpha values above 0.70. This indicates that the research instrument has good internal consistency and is capable of producing stable data in measuring the research constructs. Thus, the measurement model in this study has met the validity and reliability criteria recommended in SEM-PLS analysis (Hair & Alamer, 2022; Henseler et al., 2023; Sarstedt et al., 2023).

**The Impact of Generative AI Integration on Technopreneurship Strategy**

The results of the structural model analysis indicate that the integration of generative AI has a positive and significant impact on technopreneurship strategies within the startup ecosystem. The path coefficient indicates that the higher the utilization of generative AI technology in startups, the stronger the technological innovation strategy implemented by the company. This suggests that AI technology can be a key driving factor in the development of technology-based entrepreneurial strategies (Deloitte, 2024).

**Table 6.** Hypothesis Testing Results

<b>Variable Relationship</b>	<b>Path Coefficient</b>	<b>T-Statistic</b>	<b>Results</b>
Generative AI → Technopreneurship	0.63	8.12	Significant
Technopreneurship → Global Competitiveness	0.59	7.45	Significant
Generative AI → Global Competitiveness	0.41	5.76	Significant

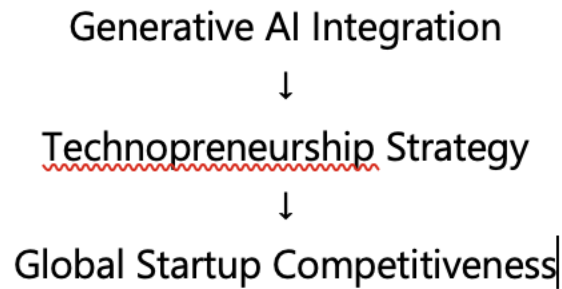
*Source: SmartPLS Analysis Results, 2026*

These findings indicate that startups that utilize generative AI tend to be more innovative in product development, improve operational efficiency, and create digital business models that are more adaptive to market changes. Generative AI technology also enables startups to accelerate the innovation process by automating various business activities such as data analysis, digital content development, and product design. This provides a competitive advantage for companies that are able to optimally utilize this technology (Gartner, 2025; IBM Institute for Business Value, 2024; Singh et al., 2024).

Furthermore, this study also shows that technopreneurship strategies play a crucial role as a mediator between technology and business competitiveness. In other words, generative AI technology does not automatically increase startup competitiveness without an appropriate technology entrepreneurship strategy. Therefore, technology integration must be accompanied by the development of innovation strategies capable of creating sustainable business value (OECD, 2024; World Economic Forum, 2024; CB Insights, 2025).

### **The Role of Generative AI in Enhancing Startups' Global Competitiveness**

Research also shows that the integration of generative AI has a positive impact on increasing startups' global competitiveness. Startups that utilize AI technology tend to have better capabilities in developing product innovations, improving operational efficiency, and expanding global market access. This suggests that AI technology can be a source of competitive advantage for startups in facing increasingly complex global competition.



**Figure 1.** Research Variable Relationship Model

Source: Research Model, 2026

In addition to improving operational efficiency, generative AI technology also enables startups to develop product innovations faster and more relevant to global market needs. AI's ability to analyze large amounts of data allows companies to understand customer behavior more deeply, thereby developing products that better meet user needs. This presents significant opportunities for startups to expand internationally and enhance their competitive position in the global digital economy (Deloitte, 2024; Gartner, 2025; World Economic Forum, 2024).

The findings of this study also indicate that startups that successfully integrate generative AI technology strategically have a greater chance of attracting investment from global venture capital firms. Investors tend to be more attracted to companies that are able to leverage innovative technology to create new business value and have high growth potential. Therefore, the integration of AI technology not only impacts product innovation but also the long-term sustainability of startup businesses (Crunchbase, 2025; CB Insights, 2025; OECD, 2024).

## CONCLUSION

Based on the research analysis, it can be concluded that the integration of generative AI in the startup ecosystem plays a significant role in strengthening technopreneurship strategies and increasing the global competitiveness of startups. The SEM-PLS analysis results show that the use of generative AI can encourage increased technological innovation, operational efficiency, and the development of digital business models that are more adaptive to global market dynamics. Startups that integrate generative AI technology into their business processes tend to have better capabilities in accelerating product development processes, improving the quality of digital services, and utilizing data more effectively in strategic decision-making.

Furthermore, research findings indicate that technopreneurship strategies play a crucial role in bridging the gap between the use of generative AI technology and increasing startups' global competitiveness. The integration of AI technology not only provides advantages in terms of

technological efficiency but also encourages the emergence of new product and service innovations that can strengthen startups' positions in global competition. In other words, a startup's success in increasing global competitiveness is determined not only by the level of AI technology adoption but also by the company's ability to develop innovative, adaptive technopreneurship strategies that are oriented toward developing technology-based business value.

Overall, this study demonstrates that the integration of generative AI is a key strategy in developing a modern startup ecosystem oriented towards innovation and global competitiveness. Therefore, startups need to develop a strategic approach to utilizing generative AI technology by increasing innovation capacity, strengthening digital competencies, and collaborating within the broader technology ecosystem. The findings of this study are expected to provide theoretical contributions to the development of technopreneurship literature and serve as a practical reference for startups, investors, and policymakers in formulating technology-based startup development strategies in the era of the global digital economy.

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