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Examining the Impact of the Digital Economy and the Internet of Things on Entrepreneurial Development (A Study from the Perspective of Startup Business Owners in Kermanshah Province)

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Abstract

Entrepreneurship is widely recognized as a key driver of economic growth, and governments across societies support entrepreneurial activities through various programs and incentives. The objective of this study was to examine the impact of the digital economy and the Internet of Things on entrepreneurial development. In terms of purpose, the research is applied, and in terms of nature, it is descriptive-survey. The data collection method was library-based, and the tool used was note-taking. The statistical population consisted of managers and employees of startup businesses in Kermanshah Province. Due to the dispersion of the population, simple random sampling was employed, and the sample size was determined to be 384 individuals. Data collection was conducted in the field using questionnaires, including a researcher-developed digital economy questionnaire, a researcher-developed Internet of Things questionnaire, and the entrepreneurial development questionnaire by Antoncic and Hisrich (2003). The validity of the questionnaires was confirmed by experts, and their reliability was calculated using Cronbach's alpha, yielding coefficients of 0.79 for the digital economy, 0.81 for the Internet of Things, and 0.78 for entrepreneurial development. Data analysis was performed using descriptive statistics (mean and standard deviation) and structural equation modeling with the aid of SPSS version 26 and AMOS version 24 software. The findings indicated that the digital economy, with a significance level of 0.001 and a standardized coefficient of $\beta = 0.51$, and the Internet of Things, with a significance level of 0.001 and a standardized coefficient of $\beta = 0.12$, have a significant effect on entrepreneurial development. Additionally, goodness-of-fit indices across all factors were at an acceptable level. The results suggest that the digital economy and the Internet of Things are two critical factors and tools influencing the development of entrepreneurship in startup businesses.

Keywords: Digital economy, Internet of Things, entrepreneurial development, startup businesses.

1. Introduction

The contemporary global economy is undergoing a profound transformation driven by rapid advancements in digital technologies, fundamentally reshaping traditional economic structures and redefining the nature of entrepreneurship. The emergence of the digital economy has introduced new paradigms for value creation, resource allocation, and market interaction,

enabling entrepreneurs to operate in highly dynamic, interconnected, and data-driven environments. In this context, digital technologies have become critical enablers of innovation, competitiveness, and economic growth, particularly for startup businesses that rely heavily on agility and technological integration. The digital economy is not merely a technological shift but a comprehensive transformation that influences organizational strategies, market behaviors, and entrepreneurial ecosystems, thereby facilitating new forms of entrepreneurial activities and opportunities (Bernardino et al., 2023; Li, 2023; Redondo-Rodríguez et al., 2023).

Entrepreneurship, as a key driver of economic development, plays a central role in fostering innovation, employment generation, and competitiveness across economies. In recent years, the intersection of entrepreneurship with digital technologies has given rise to the concept of digital entrepreneurship, which emphasizes the utilization of digital platforms, tools, and infrastructures to create and scale new ventures. Digital entrepreneurship is increasingly recognized as a critical component of modern economic systems, as it leverages technological capabilities to overcome traditional barriers such as geographical limitations, resource constraints, and market access challenges. The integration of digital ecosystems with entrepreneurial ecosystems enhances the capacity of startups to innovate and compete in global markets, thereby contributing to sustainable economic development (Ali & Jabeen, 2024; Gafsi, 2025; Wibisono, 2023).

One of the most significant technological advancements contributing to the evolution of the digital economy is the Internet of Things (IoT), which facilitates the interconnection of devices, systems, and services through real-time data exchange. The IoT has transformed various sectors by enabling intelligent decision-making, automation, and enhanced operational efficiency. In the context of entrepreneurship, IoT technologies provide startups with opportunities to develop innovative products and services, optimize business processes, and create new business models. The integration of IoT into entrepreneurial activities not only enhances productivity but also fosters the development of smart environments, such as smart cities, where digital infrastructure supports entrepreneurial marketing and innovation (Okorie et al., 2024; Rahdar & Asgharian, 2023; Saqebi, 2022).

Moreover, the digital economy and IoT collectively contribute to the development of entrepreneurial competencies, including opportunity recognition, innovation capability, and strategic decision-making. The availability of large volumes of data and advanced analytics tools enables entrepreneurs to better understand market trends, customer preferences, and competitive dynamics. This, in turn, enhances their ability to identify and exploit entrepreneurial opportunities. Furthermore, digital literacy and technological skills have become essential prerequisites for successful entrepreneurship in the digital era, as they enable individuals to effectively utilize digital tools and platforms for business development and growth (Nugroho et al., 2023; Wardana, 2023; Zhao et al., 2023).

The role of digital transformation in fostering entrepreneurial development has also been highlighted in various empirical studies, which demonstrate that digital technological innovations significantly influence entrepreneurial orientation, performance, and sustainability. For instance, the adoption of digital marketing strategies, digital platforms, and online business models has been shown to enhance the competitiveness of startups by enabling them to reach broader markets and improve customer engagement. Additionally, digital transformation contributes to the resilience of entrepreneurial ventures, particularly in the face of external shocks such as economic crises or global pandemics, by facilitating adaptability and strategic flexibility (Mweha, 2025; Samus et al., 2025; Suryapermana, 2024).

Despite the numerous advantages associated with the digital economy and IoT, several challenges and barriers hinder their effective utilization in entrepreneurial contexts. These challenges include issues related to digital infrastructure, regulatory frameworks, cybersecurity, data privacy, and access to financial resources. Furthermore, the successful implementation of digital technologies in entrepreneurship requires a supportive institutional environment, adequate human capital, and effective policy interventions. In emerging economies, where digital transformation is still evolving, these challenges are more pronounced, necessitating targeted strategies to enhance digital readiness and entrepreneurial capacity (Alomar & Alatawi, 2025; D'Ignazio et al., 2025; Maslov, 2023).

In addition, the dynamics of high-growth startups in the digital economy highlight the importance of innovation, scalability, and network effects in achieving sustainable entrepreneurial success. Digital platforms and ecosystems enable startups to rapidly scale their operations and create value through network-based interactions, thereby increasing their competitive

advantage. However, this also requires entrepreneurs to possess advanced strategic capabilities and to navigate complex market environments characterized by intense competition and rapid technological change. The interplay between technological innovation, entrepreneurial orientation, and market dynamics underscores the need for a comprehensive understanding of the factors influencing entrepreneurial development in the digital age (Eisenmann, 2025; Lahtinen et al., 2024; Li et al., 2024).

Furthermore, the integration of digital technologies into entrepreneurial activities has significant implications for social and economic development, as it promotes inclusivity, innovation, and sustainable growth. Digital entrepreneurship has the potential to empower marginalized groups, enhance access to resources, and create new economic opportunities, thereby contributing to broader societal development. Studies have also emphasized the role of digital technological innovations in enhancing the economic participation of various demographic groups, including women and small business owners, by providing them with the tools and platforms necessary to engage in entrepreneurial activities (Mehralian, 2022; Sanaeepour et al., 2022; Ziyae et al., 2022).

At the organizational level, factors such as human resource empowerment, organizational capabilities, and managerial competencies play a crucial role in facilitating the adoption and effective use of digital technologies in entrepreneurship. Empowered human resources are better equipped to leverage digital tools, innovate, and adapt to changing market conditions, thereby enhancing organizational productivity and entrepreneurial performance. This highlights the importance of investing in human capital development and fostering a culture of innovation within organizations to support digital transformation and entrepreneurial growth (Mousakhani et al., 2020; Najarian et al., 2022).

Overall, the convergence of the digital economy and IoT represents a transformative force that is reshaping the landscape of entrepreneurship, creating new opportunities while also posing significant challenges. Understanding the impact of these technologies on entrepreneurial development is essential for policymakers, practitioners, and researchers seeking to promote innovation-driven economic growth and sustainable development. Therefore, the present study aims to examine the impact of the digital economy and the Internet of Things on the development of entrepreneurship in startup businesses.

2. Methods and Materials

This study is applied in terms of purpose and descriptive–survey in nature. The method of data collection was library-based, and the instrument used was note-taking from books, articles, and other sources. The statistical population consisted of managers and employees of startup businesses in Kermanshah Province. (Startup businesses refer to enterprises that have been recently established and operate based on creative ideas and innovation. In this study, businesses established after 2016 were examined.) Due to the dispersion of the statistical population, simple random sampling was employed, and the sample size was determined to be 384 individuals. Data collection was conducted through fieldwork, and the instruments used included the Digital Economy Questionnaire (researcher-developed), the Internet of Things Questionnaire (researcher-developed), and the Entrepreneurial Development Questionnaire developed by Antoncic and Hisrich (2003), which are described below.

a) **Digital Economy Questionnaire:** This questionnaire consists of 10 items designed on a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree). The scoring method ranges from 5 to 1. The minimum possible score is 10 and the maximum is 50. The validity of the questionnaire was confirmed by experts, and its reliability was calculated using Cronbach's alpha coefficient, which was 0.79.

b) **Internet of Things Questionnaire:** This questionnaire contains 11 items measured on a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree). The scoring method ranges from 5 to 1. The minimum possible score is 11 and the maximum is 55. The validity of the questionnaire was confirmed by experts, and its reliability was calculated using Cronbach's alpha coefficient, which was 0.81.

c) **Entrepreneurial Development Questionnaire (Antoncic and Hisrich, 2003):** This questionnaire includes 20 items designed on a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree). The scoring method ranges from 5 to 1. The minimum possible score is 20 and the maximum is 100. The validity of the questionnaire was confirmed, and its reliability was calculated using Cronbach's alpha coefficient, which was 0.78.

Data analysis was conducted using descriptive statistics (mean and standard deviation) and structural equation modeling with SPSS version 26 and AMOS version 24 software.

3. Findings and Results

Table 1 presents the demographic characteristics of the respondents in the present study in terms of gender, marital status, educational level, age, and work experience.

Table 1. Demographic Characteristics of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Female	139	36.2
	Male	245	63.8
Marital Status	Single	125	32.6
	Married	259	67.4
Education Level	Associate Degree	40	10.4
	Bachelor's Degree	121	31.5
	Master's Degree	138	35.9
	Doctoral Degree	85	22.2
Age	30–35 years	110	28.6
	36–40 years	112	29.2
	41–45 years	96	25.0
	Above 45 years	66	17.2
Work Experience	Less than 5 years	162	42.2
	5–10 years	151	39.3
	More than 10 years	71	18.5

In terms of gender, the majority of respondents were male and married. Regarding educational level, more than 35% held a master's degree, and over 22% possessed a doctoral degree. This indicates that more than half of the respondents had higher education and adequate work experience, which contributes to the quality and reliability of the data.

Table 2. Central Indices (Descriptive Statistics)

Variable	Mean	Standard Deviation
Digital Economy	3.12	0.789
Digital Infrastructure	3.88	0.973
Communication Networks	3.84	1.003
Digital Markets	3.85	1.137
Service Platforms	3.86	0.953
Digital Goods and Services	3.89	0.961
Digital Content	3.87	0.990
Digital Workforce	3.85	1.032
Skilled Individuals	3.80	0.956
Economic Data	3.70	1.044
Digital Economy Skills and Knowledge	3.71	1.057
Internet of Things	3.08	0.765
Perceived Usefulness	3.58	1.076
Ease of Use	3.64	1.109
Trust	3.54	1.135
Social Influence	3.60	1.020
Enjoyment	3.71	1.034
Behavioral Control	3.96	0.962
Technology Acceptance	3.93	1.045
Data Processing	3.93	1.020
Data Transmission	3.81	1.097
User Interface	3.61	0.093
Data Collection	3.89	0.970
Entrepreneurial Development	3.11	0.789
Identification of New Businesses	3.89	0.965
Willingness to Innovate at Work	3.84	1.002
Curiosity About New Ideas	3.85	1.135
Willingness to Perform New Tasks	3.84	0.963
Application of New Methods	3.88	0.967
Uncertainty	3.86	1.000
Risk-Taking	3.85	1.042

Tolerance of Ambiguity	3.76	0.980
Desire for Success	3.70	1.048
Rule-Breaking	3.70	1.056
Courage	3.57	1.077
Proactiveness in Product Development	3.62	1.103
Encouraging Others to Act	3.53	1.124
Leadership	3.59	1.028
Pioneering	3.70	1.030
Product Quality	3.95	0.969
Introduction of New Products	3.91	1.057
Access to New Technology	3.92	1.028
Market Share	3.82	1.092
Attracting Competitors' Customers	3.60	1.101

The results of the descriptive statistics presented in Table 2 indicate that the mean values of all variables are above the midpoint, suggesting that respondents provided generally favorable answers to the questionnaire items. Furthermore, the results of the indicators for each variable were examined, and the obtained values were also above the average level, indicating that the overall mean of the main variables is consistent with the mean of their respective items.

Table 3. Test of Normality of Data Distribution

Variable	Test Statistic	Significance Level
Digital Economy	0.040	0.182
Internet of Things	0.034	0.200
Entrepreneurial Development	0.040	0.178

Table 3 presents the normality of data distribution using the Kolmogorov–Smirnov test. Given that the significance level for all variables is greater than 0.05, the data follow a normal distribution. Therefore, structural equation modeling can be applied to test the research hypotheses.

Table 4. Model Fit Indices

Fit Indices	Values
CMIN/DF	4.190
NFI	0.937
RFI	0.976
IFI	0.905
TLI	0.942
CFI	0.997
RMSEA	0.079

The fit indices presented in Table 4 indicate that the research model demonstrates an acceptable level of goodness of fit.

Table 5. Testing of Research Hypotheses

Hypotheses	Effect Coefficient	Significance Level	Standardized Coefficient	Result
The digital economy has a significant effect on entrepreneurial development in startup businesses in Kermanshah Province.	0.509	0.001	0.068	Reject H_0
The Internet of Things has a significant effect on entrepreneurial development in startup businesses in Kermanshah Province.	0.116	0.001	0.074	Reject H_0

The results presented in Table 5 indicate that the research hypotheses are supported, as their significance levels are less than 0.05 and their effect coefficients are substantial.

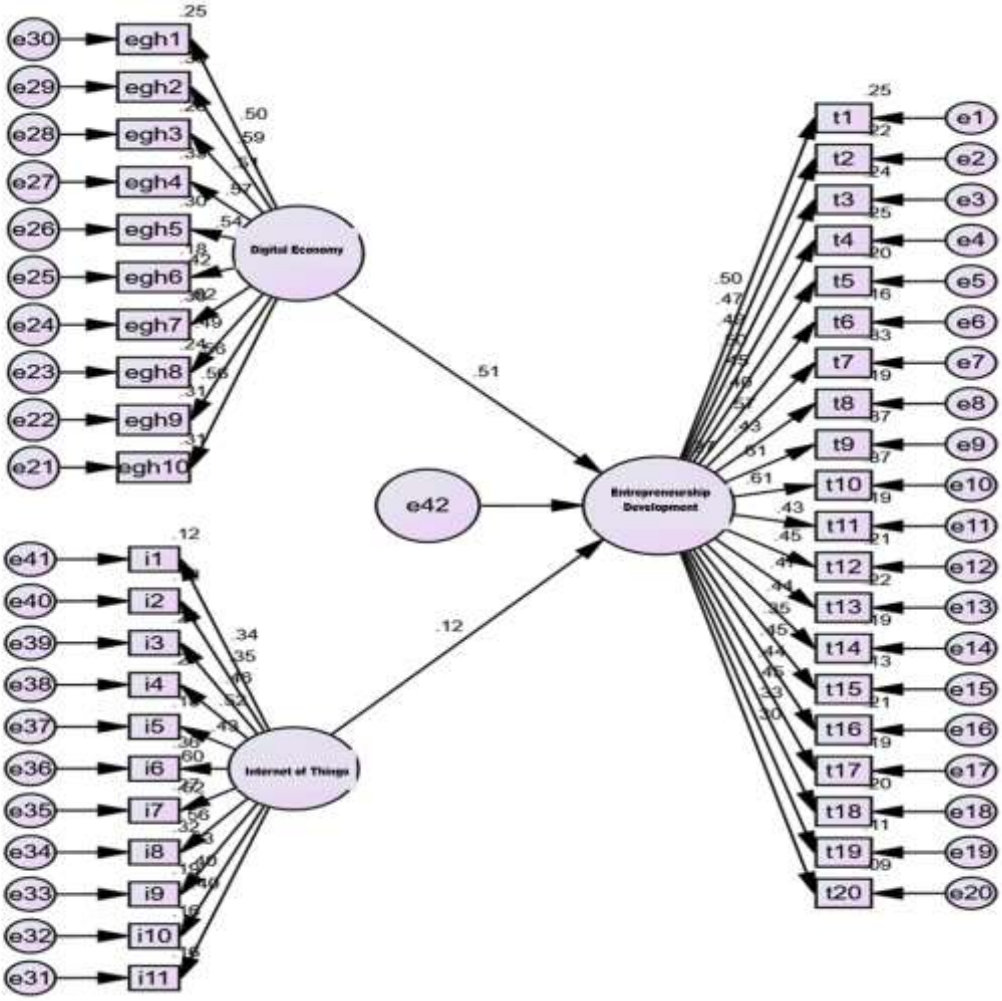

Figure 1: Structural Equation Modeling

4. Discussion and Conclusion

The findings of the present study demonstrated that both the digital economy and the Internet of Things (IoT) exert a statistically significant and positive impact on the development of entrepreneurship in startup businesses in Kermanshah Province. More specifically, the effect size of the digital economy (β = 0.51) was considerably higher than that of the Internet of Things (β = 0.12), indicating that while both variables are influential, the digital economy plays a more dominant role in shaping entrepreneurial development. These findings suggest that the structural transformation brought about by digital technologies—such as digital platforms, online markets, and data-driven decision-making—provides a more comprehensive and immediate foundation for entrepreneurial growth compared to IoT technologies, which may require more advanced infrastructure and integration. The significant relationship between the digital economy and entrepreneurial development aligns with prior studies emphasizing the role of digitalization in enhancing innovation capacity, market access, and competitive advantage among startups (Bernardino et al., 2023; Li, 2023; Redondo-Rodríguez et al., 2023).

The stronger influence of the digital economy observed in this study can be explained by its multifaceted nature, which encompasses digital infrastructure, communication networks, digital marketplaces, and digital skills. These components collectively create an enabling environment that reduces entry barriers for entrepreneurs, facilitates resource mobilization, and enhances scalability. This finding is consistent with research indicating that digital ecosystems significantly enhance entrepreneurial ecosystems by providing access to knowledge, networks, and financial resources (Ali & Jabeen, 2024; Wibisono, 2023). Furthermore, the digital economy enables startups to leverage platform-based business models and network

effects, thereby accelerating growth and innovation. The observed results also corroborate the conceptual arguments presented by Gafsi (Gafsi, 2025), who highlighted the critical role of digital infrastructures and institutional support in fostering digital entrepreneurship.

In contrast, although the Internet of Things was found to have a positive and significant effect on entrepreneurial development, its relatively smaller coefficient suggests that its impact may be more indirect or context-dependent. IoT technologies primarily contribute to entrepreneurial development through process optimization, data collection, and operational efficiency rather than directly influencing market expansion or opportunity recognition. This finding is in line with studies that emphasize the role of IoT in enhancing organizational performance and marketing effectiveness through improved data analytics and real-time monitoring (Mehralian, 2022; Okorie et al., 2024). Additionally, the integration of IoT into entrepreneurial activities often requires substantial investment in infrastructure and technical expertise, which may limit its immediate applicability for early-stage startups, particularly in emerging regions.

The results of this study further indicate that digital competencies and technological readiness play a crucial role in mediating the relationship between digital technologies and entrepreneurial outcomes. The positive effects observed can be attributed to the ability of entrepreneurs to utilize digital tools for opportunity identification, innovation, and strategic decision-making. This interpretation is supported by empirical evidence demonstrating that digital literacy and entrepreneurial attitudes significantly enhance business sustainability and innovation performance (Wardana, 2023; Zhao et al., 2023). Moreover, the findings are consistent with the work of Nugroho et al. (Nugroho et al., 2023), who argued that digital entrepreneurship strategies are essential for improving competitiveness in online business environments.

Another important implication of the findings relates to the role of digital transformation in enhancing entrepreneurial resilience. The digital economy enables startups to adapt to changing market conditions, mitigate risks, and maintain operational continuity, particularly in times of crisis. This is supported by studies highlighting the role of digital transformation in fostering strategic resilience and sustainability among entrepreneurial ventures (Mweha, 2025; Samus et al., 2025). Furthermore, digital marketing tools and online platforms allow startups to reach broader audiences and improve customer engagement, thereby enhancing their market performance and growth potential (Suryapermana, 2024).

The findings also underscore the importance of integrating technological innovation systems, such as IoT, within broader digital ecosystems to maximize their impact on entrepreneurship. While IoT alone may not significantly drive entrepreneurial development, its integration with digital platforms and data analytics can create synergies that enhance value creation and innovation. This perspective aligns with the system-based approach proposed by Mousakhani et al. (Mousakhani et al., 2020), who emphasized the interconnected nature of technological innovation systems. Similarly, Rahdar and Asgharian (Rahdar & Asgharian, 2023) highlighted the role of IoT in enhancing transparency and efficiency in business processes, which can indirectly support entrepreneurial activities.

Despite the positive effects identified, the study also highlights the existence of structural and institutional challenges that may limit the effectiveness of digital technologies in fostering entrepreneurship. Issues such as inadequate digital infrastructure, regulatory constraints, and limited access to financial resources can hinder the adoption and utilization of digital tools by startups. These challenges are particularly pronounced in emerging economies, where digital transformation is still evolving. This finding is consistent with the observations of Alomar and Alatawi (Alomar & Alatawi, 2025), who identified significant barriers to digital entrepreneurship in emerging markets. Additionally, concerns related to data privacy, cybersecurity, and digital inequality may further complicate the adoption of digital technologies in entrepreneurial contexts (D'Ignazio et al., 2025; Maslov, 2023).

Furthermore, the role of human capital and organizational capabilities in facilitating digital transformation cannot be overlooked. The effectiveness of digital technologies in enhancing entrepreneurial development is contingent upon the skills, knowledge, and adaptability of individuals and organizations. This finding is supported by research indicating that human resource empowerment and organizational productivity are critical determinants of successful technology adoption and innovation (Najarian et al., 2022). In addition, the development of digital competencies among micro-entrepreneurs has been

shown to significantly influence their ability to navigate digital markets and sustain business operations (D'Ignazio et al., 2025).

The study also contributes to the broader literature on digital entrepreneurship by providing empirical evidence on the relative importance of different technological factors in shaping entrepreneurial outcomes. The stronger impact of the digital economy compared to IoT suggests that policymakers and practitioners should prioritize investments in digital infrastructure, education, and ecosystem development to promote entrepreneurship. At the same time, efforts should be made to enhance the integration of advanced technologies, such as IoT, within entrepreneurial ecosystems to unlock their full potential. This aligns with the findings of Lahtinen et al. (Lahtinen et al., 2024), who emphasized the role of digital marketplaces in driving innovation and sustainability, as well as with Li et al. (Li et al., 2024), who highlighted the mediating role of entrepreneurship in achieving high-quality development in the digital economy.

In addition, the findings of this study reinforce the notion that digital technologies can serve as a catalyst for inclusive and sustainable economic development. By enabling access to resources, markets, and knowledge, digital entrepreneurship can empower diverse groups and promote economic participation. This is particularly relevant for marginalized populations and small businesses, as highlighted by Sanaeepour et al. (Sanaeepour et al., 2022) and Ziyae et al. (Ziyae et al., 2022). The role of IoT in supporting smart city initiatives and entrepreneurial marketing further underscores its potential to contribute to broader socio-economic development (Saqebi, 2022).

Finally, the dynamic nature of the digital economy requires continuous adaptation and innovation on the part of entrepreneurs. The rapid pace of technological change and the increasing complexity of digital markets necessitate a proactive and strategic approach to entrepreneurship. High-growth startups, in particular, must navigate these challenges by leveraging digital technologies to create scalable and sustainable business models. This perspective is supported by Eisenmann (Eisenmann, 2025), who emphasized the importance of innovation and scalability in the success of digital startups.

One of the main limitations of this study is its geographical focus on startup businesses in Kermanshah Province, which may limit the generalizability of the findings to other regions or countries with different economic and technological conditions. Additionally, the study relies on self-reported data collected through questionnaires, which may be subject to response bias and social desirability effects. The cross-sectional nature of the research design also restricts the ability to establish causal relationships between variables over time. Furthermore, the study examines only two technological factors, namely the digital economy and the Internet of Things, without considering other emerging technologies that may influence entrepreneurial development.

Future research is recommended to expand the scope of investigation by including additional variables such as artificial intelligence, blockchain, and big data analytics to provide a more comprehensive understanding of the technological determinants of entrepreneurship. Longitudinal studies could be conducted to examine the dynamic relationships between digital technologies and entrepreneurial outcomes over time. Comparative studies across different regions or countries would also be valuable in identifying contextual factors that influence the adoption and impact of digital technologies. Moreover, qualitative research methods could be employed to gain deeper insights into the experiences and challenges faced by entrepreneurs in utilizing digital technologies.

From a practical perspective, policymakers and stakeholders should prioritize the development of digital infrastructure and the promotion of digital literacy to support entrepreneurial activities. Providing training programs and capacity-building initiatives can enhance the ability of entrepreneurs to effectively utilize digital tools and technologies. Additionally, creating supportive regulatory frameworks and facilitating access to financial resources can help overcome barriers to digital entrepreneurship. Businesses should also invest in technological innovation and adopt digital strategies to enhance their competitiveness and sustainability in the evolving digital landscape.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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