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Identifying Causal Conditions Affecting Artificial Intelligence-Based Digital Entrepreneurship in Teaching Hospitals of Mazandaran University of Medical Sciences

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Abstract

Artificial intelligence-based digital entrepreneurship, as an innovative approach, can provide an effective solution for addressing existing challenges in hospitals and improving the quality of healthcare services. Therefore, the main objective of the present study was to identify the causal conditions affecting artificial intelligence-based digital entrepreneurship in the teaching hospitals of Mazandaran University of Medical Sciences. This study was applied in terms of purpose and employed a mixed-methods design (qualitative–quantitative) with an exploratory sequential approach. In the qualitative phase, grounded theory methodology was used, while in the quantitative phase, a descriptive–survey method was applied. The statistical population in the qualitative section consisted of 20 experts in AI-based digital entrepreneurship and faculty members in entrepreneurship and management, while in the quantitative section, it included all clinical faculty members and middle managers working in teaching hospitals affiliated with Mazandaran University of Medical Sciences (N = 680). In the qualitative phase, 12 participants were selected through snowball sampling based on the principle of theoretical saturation, and in the quantitative phase, 330 participants were selected using stratified random sampling according to the Krejcie and Morgan table. Data were collected using semi-structured interviews in the qualitative phase and a researcher-developed questionnaire with 21 items in the quantitative phase. The validity and reliability of the instruments were confirmed. Data analysis was conducted using structural equation modeling. In the qualitative phase, 45 open codes were extracted and organized into four main categories, including “internal factors,” “hospital performance improvement,” “enhancement of healthcare and educational services,” and “external factors,” with “AI-based digital entrepreneurship” identified as the causal condition. The results of the quantitative phase indicated that the component of “enhancement of healthcare and educational services,” with a path coefficient of 0.858 and an R^2 value of 0.743, was the strongest and most influential predictor among the causal conditions. Enhancing healthcare and educational services is one of the most important causal conditions affecting AI-based digital entrepreneurship in the teaching hospitals of Mazandaran University of Medical Sciences, and therefore, hospital administrators and policymakers should pay particular attention to this component.

Keywords: Digital entrepreneurship, artificial intelligence, teaching hospitals



1. Introduction

In recent years, the rapid advancement of digital technologies has fundamentally transformed the nature of entrepreneurship, giving rise to the concept of digital entrepreneurship as a distinct and evolving paradigm. Digital entrepreneurship refers to the creation and development of new ventures that leverage digital technologies such as artificial intelligence, big data, cloud computing, and digital platforms to generate value, innovate business models, and enhance service delivery. The increasing integration of artificial intelligence into entrepreneurial processes has further accelerated this transformation by enabling data-driven decision-making, automation, and the creation of intelligent systems capable of improving organizational performance and competitiveness (Kleinert & Vismara, 2026; Uriarte et al., 2026). In this context, digital entrepreneurship is no longer limited to traditional technology sectors but has expanded into various domains, including healthcare, education, and public services, where digital solutions are increasingly being adopted to address complex challenges.

The healthcare sector, in particular, has witnessed a significant shift toward digitalization, driven by the need to improve service quality, reduce operational costs, and enhance patient outcomes. The integration of artificial intelligence into healthcare systems has created new opportunities for digital entrepreneurship by enabling innovations such as predictive diagnostics, personalized treatment, telemedicine, and intelligent resource management. These advancements not only improve clinical outcomes but also enhance operational efficiency and patient satisfaction, thereby creating a conducive environment for entrepreneurial activities within healthcare organizations (Koulivand & Kazemi, 2020; Mohammed-Nasir et al., 2023). Consequently, teaching hospitals, as key institutions in healthcare delivery and medical education, have become important platforms for the development and implementation of AI-based digital entrepreneurship initiatives.

Despite the growing importance of digital entrepreneurship in healthcare, its successful implementation is influenced by a complex set of factors that operate at multiple levels. These factors include internal organizational capabilities, external environmental conditions, technological infrastructure, and institutional support mechanisms. Previous studies have emphasized the role of digital ecosystems in shaping entrepreneurial outcomes, highlighting the importance of interactions among various stakeholders such as government agencies, technology firms, educational institutions, and healthcare providers (Autio et al., 2025; Khaghani et al., 2026). The effectiveness of digital entrepreneurship initiatives depends not only on the availability of technological resources but also on the alignment of organizational strategies, leadership practices, and cultural readiness for innovation.

Artificial intelligence, as a key enabler of digital entrepreneurship, plays a critical role in transforming traditional business processes and creating new opportunities for value creation. By facilitating advanced data analytics, machine learning, and automation, AI technologies enable organizations to identify new market opportunities, optimize resource allocation, and enhance decision-making processes. Furthermore, the adoption of AI-driven tools, such as conversational agents and intelligent decision-support systems, has been shown to influence entrepreneurial behavior and intentions by reducing uncertainty and improving perceived feasibility and desirability of entrepreneurial activities (Barani et al., 2026; Uriarte et al., 2026). These developments highlight the transformative potential of AI in reshaping entrepreneurial ecosystems and fostering innovation across different sectors.

In addition to technological factors, the role of education and human capital development is crucial in promoting digital entrepreneurship. Higher education institutions play a significant role in equipping individuals with the knowledge, skills, and competencies required to engage in digital entrepreneurial activities. The integration of digital entrepreneurship education into academic curricula has been identified as an effective strategy for fostering innovation, creativity, and entrepreneurial mindset among students (Aysi et al., 2024; Chotisarn & Phuthong, 2026). Moreover, the use of AI-based educational tools and platforms has further enhanced the learning process by providing personalized learning experiences and facilitating knowledge transfer in digital environments (Bayat, 2022; Elsa et al., 2026). These educational advancements contribute to the development of a skilled workforce capable of driving digital transformation within organizations.

Furthermore, leadership and organizational factors play a pivotal role in shaping the success of digital entrepreneurship initiatives. Entrepreneurial leadership, characterized by vision, innovation, and risk-taking, has been identified as a key determinant of digital entrepreneurship development, particularly in knowledge-based organizations. Effective leadership can foster a culture of innovation, encourage experimentation, and facilitate the adoption of new technologies, thereby enhancing



organizational readiness for digital transformation (Esmailian et al., 2026). Similarly, organizational culture, resource availability, and strategic orientation are critical factors that influence the ability of organizations to implement and sustain digital entrepreneurship initiatives.

External environmental factors, including government policies, regulatory frameworks, and economic conditions, also play a significant role in shaping digital entrepreneurship. Supportive policies, investment in digital infrastructure, and the development of innovation ecosystems can create favorable conditions for entrepreneurial activities. Conversely, regulatory barriers, lack of infrastructure, and economic instability can hinder the growth of digital entrepreneurship. Empirical studies have demonstrated that the impact of digital entrepreneurship varies across different contexts, particularly in developing and emerging economies, where institutional and infrastructural challenges are more pronounced (Gol Ara et al., 2026; Yáñez-Valdés & Guerrero, 2024). Therefore, understanding the contextual factors that influence digital entrepreneurship is essential for designing effective policies and strategies.

In the healthcare context, the interplay between internal and external factors becomes even more critical due to the complexity and sensitivity of healthcare systems. Issues such as data privacy, ethical considerations, and patient safety add additional layers of complexity to the implementation of digital entrepreneurship initiatives. At the same time, the potential benefits of AI-based solutions in improving healthcare delivery and outcomes make it imperative for healthcare organizations to adopt innovative approaches. The successful implementation of digital entrepreneurship in teaching hospitals requires a holistic understanding of the causal conditions that influence this process, including organizational capabilities, technological readiness, and environmental support.

Although existing studies have explored various aspects of digital entrepreneurship and artificial intelligence, there is a lack of comprehensive research that integrates these perspectives within the context of healthcare institutions, particularly teaching hospitals. Most studies have focused on either technological advancements or entrepreneurial processes in isolation, without adequately addressing the complex interactions among different factors that shape digital entrepreneurship. This gap highlights the need for a systematic investigation of the causal conditions that influence the development and implementation of AI-based digital entrepreneurship in healthcare settings.

Moreover, the increasing emphasis on innovation and digital transformation in healthcare systems underscores the importance of identifying the key drivers and barriers of digital entrepreneurship. Understanding these factors can help policymakers, healthcare managers, and practitioners develop effective strategies for promoting innovation, improving service quality, and enhancing organizational performance. By identifying the causal conditions that influence digital entrepreneurship, organizations can better align their resources, capabilities, and strategies to achieve sustainable growth and competitive advantage.

Given the importance of digital entrepreneurship and the transformative potential of artificial intelligence in healthcare, this study aims to address the existing research gap by providing a comprehensive analysis of the causal conditions affecting AI-based digital entrepreneurship in teaching hospitals. The findings of this study are expected to contribute to the literature by offering new insights into the factors that influence digital entrepreneurship and by providing practical implications for healthcare organizations and policymakers.

Therefore, the aim of this study is to identify the causal conditions affecting artificial intelligence-based digital entrepreneurship in teaching hospitals of Mazandaran University of Medical Sciences.

2. Methods and Materials

This study is applied in terms of purpose, employs a mixed-methods (qualitative–quantitative) design with an exploratory sequential approach in terms of data type, and is cross-sectional in terms of data collection. In the qualitative phase, the grounded theory method based on the approach of Anselm Strauss and Juliet Corbin (2007) was used, and semi-structured interviews with experts were analyzed, while in the quantitative phase, a descriptive–survey method was applied. The statistical population in the qualitative section consisted of 20 experts in artificial intelligence-based digital entrepreneurship and faculty members in entrepreneurship and management holding the academic rank of associate professor or higher with more than 10 years of professional experience. In the quantitative section, the population included all clinical faculty members and middle managers working in teaching hospitals affiliated with Mazandaran University of Medical Sciences (Imam Khomeini Hospital,



Bu-Ali Sina Hospital, Zare Hospital, Fatemeh Zahra Hospital in Sari, and Razi Hospital in Qaemshahr) who are directly involved in healthcare service delivery, quality management, and the implementation of digital technologies, totaling 680 individuals. In the qualitative phase, 12 participants were selected using snowball sampling based on the principle of theoretical saturation, and in the quantitative phase, 330 participants were selected using stratified random sampling based on hospital, gender, and organizational affiliation according to the Krejcie and Morgan table (see Table 1).

Table 1. Distribution of Statistical Population and Sample by Hospital, Gender, and Organizational Affiliation

Hospital	Clinical Faculty (Male) Population	Sample	Clinical Faculty (Female) Population	Sample	Middle Manager (Male) Population	Sample	Middle Manager (Female) Population	Sample	Total Population	Total Sample
Imam Khomeini – Sari	50	30	45	25	35	18	20	10	150	83
Bu-Ali Sina – Sari	45	25	37	18	25	10	10	5	117	58
Zare – Sari	45	20	23	12	35	13	8	5	111	50
Fatemeh Zahra – Sari	55	30	40	20	35	13	15	8	145	71
Razi – Qaemshahr	55	25	35	15	40	18	27	10	157	68
Total	250	130	180	90	170	72	80	38	680	330

Data collection tools in the qualitative phase consisted of semi-structured interviews, while in the quantitative phase, a researcher-developed questionnaire on artificial intelligence-based digital entrepreneurship was used. This questionnaire included 21 items and four dimensions: “internal factors,” “hospital performance improvement,” “enhancement of healthcare and educational services,” and “external factors.” It was designed using a five-point Likert scale (strongly disagree, disagree, neutral, agree, strongly agree), scored from 1 to 5, respectively. Face validity and content validity of the instruments were confirmed by experts, and convergent validity was assessed using the Average Variance Extracted (AVE). The AVE values for all constructs were greater than 0.50, indicating adequate convergent validity. Reliability was assessed using Cronbach’s alpha and composite reliability, with values exceeding 0.70 for all dimensions, which is considered acceptable (see Table 2).

Table 2. Validity and Reliability of Data Collection Instruments

Latent Variables	AVE	Cronbach’s Alpha	Composite Reliability
Internal Factors	0.764	0.937	0.951
Hospital Performance Improvement	0.724	0.903	0.929
Enhancement of Healthcare and Educational Services	0.562	0.803	0.864
External Factors	0.693	0.889	0.919
AI-Based Digital Entrepreneurship	1.000	1.000	1.000

Data analysis in the qualitative phase was conducted through open, axial, and selective coding. In the quantitative phase, structural equation modeling was used to examine the research questions. Data analysis was performed using SPSS version 21, SmartPLS version 3.2, and MAXQDA version 2020.

3. Findings and Results

In this study, qualitative data analysis was conducted using the grounded theory approach in three stages: open coding, axial coding, and selective coding. In the open coding stage, the transcripts of interviews conducted with 12 experts were examined line by line, and key concepts were extracted. As a result of this stage, a total of 45 open codes were derived directly from the interview texts. These codes included concepts such as “employees’ level of knowledge and skills,” “physicians’ acceptance of technology,” “organizational culture,” “financial resources,” “continuous training,” “change management,” “managers’ attitudes,” “data security,” “government support,” “internet infrastructure,” “data privacy regulations,” “collaboration with technology companies,” “integrated standards,” and “startup development.” In the axial coding stage, the open codes were organized under two main components.

Internal factors included the subcategories of “human resources” (knowledge, skills, acceptance, attitudes), “financial and technological resources” (investment, IT infrastructure, data security), “management and organizational culture” (innovation



culture, change management, interdepartmental collaboration), and “training and support” (continuous training, technical support). External factors included the subcategories of “government support and policymaking” (laws, regulations, public investment), “macro-level infrastructure” (internet, national databases, standards), “technology ecosystem” (technology firms, startups, international collaborations), and “data accessibility” (data quality, information standardization).

In the selective coding stage, causal conditions were identified as the contextual and environmental factors influencing the implementation of digital entrepreneurship. These conditions indicate that the successful adoption of artificial intelligence in hospitals requires simultaneous attention to both intra-organizational factors (human, financial, and cultural resources) and extra-organizational factors (government support, infrastructure, and the technology ecosystem).

Table 3. Coding of Experts’ Opinions on Causal Conditions Affecting AI-Based Digital Entrepreneurship (Influencing Factors)

Expert Statement	Open Coding	Axial Coding	Selective Coding
Expert 1: Among internal factors, the level of knowledge and skills of hospital staff in digital technology is very important. Among external factors, government support and macro-level policies in digital transformation play a key role.	1. Staff knowledge and skills in digital technology 2. Government support for digital transformation 3. Macro-level digital transformation policies	Internal factors – Human resources (1) External factors – Government support (2), Policymaking (3)	Causal conditions (influencing factors)
Expert 2: The success of this implementation depends on the acceptance of technology by physicians and hospital staff (internal factor) and access to advanced internet and AI infrastructure (external factor).	4. Technology acceptance by physicians and staff 5. Access to advanced internet infrastructure 6. Access to advanced AI infrastructure	Internal factors – Human resources (4) External factors – Macro infrastructure (5, 6)	
Expert 3: An important internal factor is the hospital’s organizational culture and its readiness to accept innovation. External factors include laws and regulations related to patient data privacy.	7. Organizational culture 8. Organizational readiness for innovation 9. Patient data privacy regulations	Internal factors – Organizational culture (7, 8) External factors – Laws and regulations (9)	
Expert 4: Hospital financial resources and the level of investment in new technologies are among the most important internal factors. Externally, collaboration between hospitals and technology companies can significantly affect success.	10. Hospital financial resources 11. Investment in new technologies 12. Collaboration with technology companies	Internal factors – Financial resources (10, 11) External factors – Technology ecosystem (12)	
Expert 5: Continuous training of physicians and healthcare staff for using AI-based tools is a vital internal factor. On the other hand, access to high-quality medical data as an external factor greatly affects the accuracy of AI systems.	13. Continuous training of physicians and staff 14. Use of AI-based tools 15. Access to high-quality medical data	Internal factors – Training and support (13, 14) External factors – Data accessibility (15)	
Expert 6: Internal factors include change management and how digital transformation processes are implemented in hospitals. At the external level, developing integrated standards for interaction between AI systems and other hospital systems is essential.	16. Change management in hospitals 17. Implementation of digital transformation processes 18. Development of integrated system standards	Internal factors – Management and organizational culture (16, 17) External factors – Standards (18)	
Expert 7: A positive attitude of hospital managers toward technology use and their support is an important internal factor. Externally, the country’s economic conditions and government investment in digital health play a key role.	19. Managers’ positive attitude toward technology 20. Managerial support for technology 21. National economic conditions 22. Government investment in digital health	Internal factors – Human resources (19, 20) External factors – Government support (22), Economic conditions (21)	
Expert 8: The readiness of hospital IT systems and the level of data security are important internal factors. Externally, laws related to patient data usage and ethical issues have a strong impact.	23. IT readiness 24. Data security level 25. Laws on patient data usage 26. Ethical issues in data use	Internal factors – Financial and technological resources (23, 24) External factors – Laws and regulations (25, 26)	
Expert 9: Support and coordination among hospital departments for implementing AI-based projects is a critical internal factor. Externally,	27. Interdepartmental support	Internal factors – Management and	



the growth and development of AI technologies in the country are influential.	28. Interdepartmental coordination 29. Growth of AI technologies 30. Development of AI technologies	organizational culture (27, 28) External factors – Technology ecosystem (29, 30)
Expert 10: Internal factors include collaboration between medical teams and hospital IT teams. External factors highlight the need for international collaboration to adopt best global practices.	31. Collaboration between medical and IT teams 32. International collaboration 33. Adoption of global best practices	Internal factors – Management and organizational culture (31) External factors – Technology ecosystem (32, 33)
Expert 11: The level of patients’ awareness and acceptance of digital services is an important internal factor. Externally, the growth of startups in digital health can significantly accelerate this process.	34. Patients’ awareness of digital services 35. Patients’ acceptance of digital services 36. Growth of digital health startups	Internal factors – Human resources (34, 35) External factors – Technology ecosystem (36)
Expert 12: Internally, technical support and rapid access to maintenance services for AI equipment are very important. Externally, the development of national databases and the standardization of medical information are highly significant.	37. Technical support for AI equipment 38. Rapid access to maintenance services 39. Development of national databases 40. Standardization of medical information	Internal factors – Training and support (37, 38) External factors – Macro infrastructure (39, 40)

These eight components constitute a comprehensive framework of causal conditions necessary for the formation and success of artificial intelligence-based digital entrepreneurship in hospitals. The integration of these internal and external factors provides an appropriate foundation for implementing technological innovations within the healthcare system.

In the quantitative phase, based on participants’ perspectives, the dimension of causal conditions along with its components and indicators, and their level of influence on AI-based digital entrepreneurship in teaching hospitals of Mazandaran University of Medical Sciences, were analyzed using structural equation modeling, as illustrated in Figure 1.

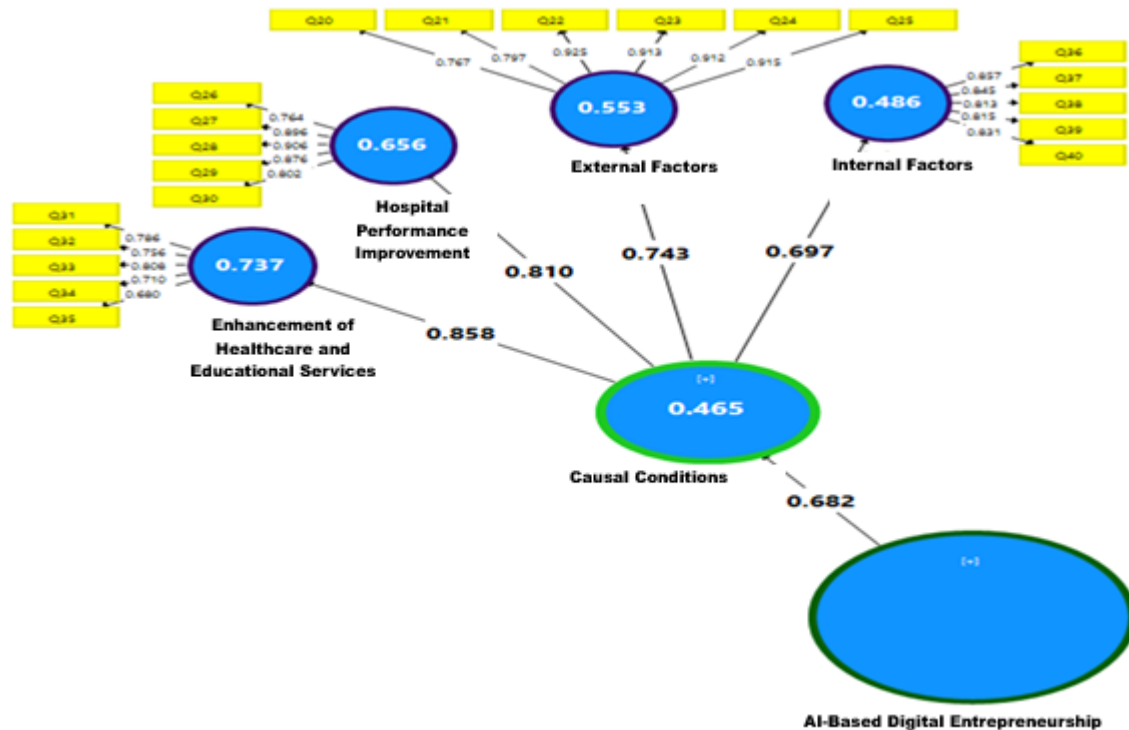


Figure 1. Relationship between causal conditions and AI-based digital entrepreneurship in the path coefficient estimation model.



4. Discussion and Conclusion

The present study aimed to identify the causal conditions affecting artificial intelligence-based digital entrepreneurship in teaching hospitals, and the findings provide a comprehensive and empirically grounded understanding of the multidimensional nature of these conditions. The results indicated that causal conditions, encompassing internal factors, hospital performance improvement, enhancement of healthcare and educational services, and external factors, significantly explain a substantial proportion of the variance in digital entrepreneurship. Specifically, the overall path coefficient for causal conditions was 0.682, with an explanatory power of 46.5%, highlighting that nearly half of the success of AI-based digital entrepreneurship in healthcare settings is determined by pre-existing contextual and structural conditions. This finding underscores the critical importance of establishing a conducive environment before initiating digital transformation initiatives, which is consistent with prior research emphasizing the role of contextual readiness in digital entrepreneurship ecosystems (Autio et al., 2025; Khaghani et al., 2026).

Among the identified components, the “enhancement of healthcare and educational services” emerged as the strongest predictor, with a path coefficient of 0.858 and an R^2 value of 0.743. This result suggests that the primary driver of AI-based digital entrepreneurship in hospitals is the intention to improve the quality, accessibility, and effectiveness of healthcare and medical education. This finding aligns with the broader literature indicating that digital entrepreneurship is often motivated by the pursuit of value creation through improved service delivery and user outcomes (Yáñez-Valdés & Guerrero, 2024). In the healthcare context, this translates into the adoption of AI technologies for enhancing diagnostic accuracy, expanding access to specialized services through telemedicine, and improving coordination among medical teams. Previous studies have similarly highlighted that digital innovation in healthcare is primarily driven by the need to address inefficiencies and improve patient outcomes, reinforcing the central role of service enhancement as a key motivator for entrepreneurial activities (Mohammed-Nasir et al., 2023).

The second most influential component, “hospital performance improvement,” with a path coefficient of 0.810, indicates that operational efficiency and resource optimization are also significant drivers of digital entrepreneurship. The findings show that hospital administrators are motivated to adopt AI technologies to reduce costs, streamline processes, and improve the allocation of human and material resources. This is consistent with the literature on digital transformation, which emphasizes the role of efficiency gains and cost reduction as key incentives for technology adoption (Kleinert & Vismara, 2026). The ability of AI systems to automate routine tasks, enhance decision-making, and optimize workflows contributes to improved organizational performance, thereby creating favorable conditions for entrepreneurial initiatives within healthcare institutions.

The “external factors” component, with a path coefficient of 0.697, also demonstrated a significant influence on digital entrepreneurship. This highlights the importance of macro-level conditions such as government support, regulatory frameworks, economic stability, and technological infrastructure in shaping entrepreneurial outcomes. The strong impact of government support and policymaking, as reflected in the high coefficient of related indicators, indicates that institutional backing is essential for the successful implementation of AI-based initiatives. This finding is in line with previous studies that have identified supportive policies and investment in digital infrastructure as critical enablers of digital entrepreneurship, particularly in developing and emerging economies (Autio et al., 2025; Gol Ara et al., 2026). Moreover, the role of the technology ecosystem, including collaboration with startups and technology firms, further emphasizes the importance of external networks and partnerships in facilitating innovation and knowledge exchange.

Interestingly, although “internal factors” were found to be significant, their relative influence was lower compared to other components. This suggests that while organizational resources such as human capital, financial capacity, and cultural readiness are important, they may not be sufficient on their own to drive digital entrepreneurship. Instead, their effectiveness depends on the interaction with external conditions and the extent to which they contribute to improving service outcomes and operational performance. This finding can be interpreted in light of the ecosystem perspective of entrepreneurship, which posits that entrepreneurial success is the result of dynamic interactions among multiple actors and factors rather than isolated organizational capabilities (Khaghani et al., 2026). Additionally, the relatively lower impact of internal factors may indicate that certain capabilities, such as skills and knowledge, can be developed over time, whereas external support and performance outcomes serve as more immediate drivers of adoption.



At the level of individual indicators, the findings provide further insights into the specific mechanisms through which causal conditions influence digital entrepreneurship. Within internal factors, financial resources and investment emerged as the most critical elements, highlighting the necessity of adequate funding for initiating and sustaining digital initiatives. This is consistent with prior research emphasizing the role of financial capital as a key determinant of entrepreneurial activity (Esmailian et al., 2026). Similarly, data security was identified as a crucial factor, reflecting the importance of trust and risk management in the adoption of AI technologies. In healthcare settings, where sensitive patient information is involved, ensuring data privacy and security is essential for gaining stakeholder acceptance and complying with regulatory requirements.

Within the performance improvement component, the highest-ranking indicators were related to resource allocation and process efficiency, indicating that practical and operational considerations play a central role in decision-making. This finding supports the view that digital entrepreneurship in healthcare is not only driven by strategic considerations but also by the need to address immediate operational challenges. The emphasis on reducing medical errors and improving staff productivity further highlights the potential of AI technologies to enhance the quality and reliability of healthcare services, thereby contributing to organizational effectiveness (Koulivand & Kazemi, 2020).

In the “enhancement of healthcare and educational services” component, the importance of diagnostic accuracy and access to specialized services reflects the patient-centered nature of digital entrepreneurship in healthcare. These findings are consistent with the literature on AI applications in medicine, which demonstrates the ability of AI systems to improve clinical decision-making and expand access to care through digital platforms (Uriarte et al., 2026). Furthermore, the role of AI in medical education and research underscores its potential to transform not only service delivery but also knowledge creation and dissemination. The integration of AI into educational processes enhances learning outcomes and prepares future healthcare professionals for the digital age (Aysi et al., 2024; Elsa et al., 2026).

The significance of external factors, particularly government support and infrastructure, highlights the systemic nature of digital entrepreneurship. The findings suggest that without a supportive policy environment and adequate technological infrastructure, even well-resourced organizations may face challenges in implementing digital initiatives. This is particularly relevant in the context of developing countries, where infrastructural and institutional barriers can impede innovation. The importance of collaboration with technology firms and startups further emphasizes the role of networks and partnerships in fostering innovation and facilitating access to resources and expertise (Barani et al., 2026; Chotisarn & Phuthong, 2026).

Overall, the results of this study contribute to the existing literature by providing an integrated framework for understanding the causal conditions of AI-based digital entrepreneurship in healthcare. The findings highlight the interplay between internal capabilities, performance outcomes, and external environmental factors, demonstrating that successful digital entrepreneurship requires a holistic and systemic approach. This perspective aligns with contemporary views on digital transformation, which emphasize the need for alignment among technological, organizational, and institutional dimensions to achieve sustainable innovation (Dehghan Saein & Arefi, 2023; Kleinert & Vismara, 2026).

The study also extends previous research by emphasizing the central role of service enhancement as a primary driver of digital entrepreneurship in healthcare. While previous studies have focused on technological and economic factors, the present findings highlight the importance of patient outcomes and educational quality as key motivators for adopting AI technologies. This insight has important implications for both theory and practice, as it suggests that digital entrepreneurship should be conceptualized not only as a means of achieving economic gains but also as a strategy for improving social and health outcomes.

The limitations of this study should be acknowledged. First, the research was conducted within a specific geographical and institutional context, namely teaching hospitals affiliated with a single university, which may limit the generalizability of the findings to other settings. Second, the cross-sectional design of the study does not allow for the examination of causal relationships over time, and longitudinal studies are needed to capture the dynamic nature of digital entrepreneurship. Third, the reliance on self-reported data may introduce response bias, as participants’ perceptions may not fully reflect actual practices. Additionally, the use of a researcher-developed questionnaire, although validated, may limit comparability with other studies using standardized instruments.

Future research should address these limitations by conducting studies in diverse contexts and across different types of healthcare institutions to enhance the generalizability of the findings. Longitudinal and experimental designs could provide deeper insights into the causal mechanisms and temporal dynamics of digital entrepreneurship. Moreover, future studies could



explore the role of emerging technologies, such as blockchain and the Internet of Things, in shaping digital entrepreneurship ecosystems. Investigating the interaction between cultural, institutional, and technological factors could also provide a more nuanced understanding of the conditions that facilitate or hinder digital entrepreneurship. Finally, comparative studies across countries and regions could shed light on the impact of different policy and institutional environments on digital entrepreneurship development.

Page | 9 From a practical perspective, the findings of this study highlight the importance of adopting a comprehensive and integrated approach to promoting digital entrepreneurship in healthcare. Policymakers and hospital administrators should prioritize investments in digital infrastructure, ensure data security, and create supportive regulatory frameworks to facilitate innovation. Emphasis should also be placed on enhancing healthcare services and educational quality, as these are key drivers of digital entrepreneurship. Furthermore, fostering collaboration with technology firms and startups can provide access to new knowledge, resources, and innovative solutions. Developing training programs to enhance digital skills among healthcare professionals and promoting a culture of innovation within organizations are also essential steps toward achieving successful digital transformation.

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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