

Article

Digital Entrepreneurial Ecosystem Embeddedness, Knowledge Dynamic Capabilities, and User Entrepreneurial Opportunity Development in China: The Moderating Role of Entrepreneurial Learning

Jinbo Zhou and Weiren Cen *

School of Economics and Management, Guangxi Normal University, Guilin 541004, China; jbzhou@gxnu.edu.cn

* Correspondence: wrcen@stu.gxnu.edu.cn; Tel.: +86-1821-907-4255

Abstract: Digital entrepreneurial ecosystem embeddedness disrupts existing boundaries and content of innovative entrepreneurial activities, restructuring entrepreneurial landscape. However, how it drives the process and mechanisms of user entrepreneurial opportunity development remains underexplored. Based on entrepreneurial ecosystem theory and knowledge dynamic capability theory, this study examines the mediating role of knowledge dynamic capabilities in the relationship between digital entrepreneurial ecosystem embeddedness and user entrepreneurial opportunity development. Using a sample of 232 user entrepreneurial enterprises in China, hierarchical regression analysis and bootstrap methods are employed to investigate the mechanisms. The results reveal that digital entrepreneurial ecosystem embeddedness significantly promotes knowledge acquisition and sharing capabilities, which in turn facilitate entrepreneurial opportunity development. Moreover, under higher levels of entrepreneurial learning, the promotion of knowledge acquisition and sharing capabilities by digital entrepreneurial ecosystem embeddedness becomes more significant. Furthermore, knowledge dynamic capabilities, consisting of knowledge acquisition and sharing capabilities, significantly promote entrepreneurial opportunity development, partially mediating the relationship between digital entrepreneurial ecosystem embeddedness and entrepreneurial opportunity development. Additionally, knowledge sharing capability serves as the preferable pathway in the dual-driven process of digital entrepreneurial ecosystem embeddedness and entrepreneurial opportunity development. Our findings contribute to understanding the dynamics of user entrepreneurship in China in the digital environment, and offer practical insights for leveraging digital embeddedness to improve the quality and efficiency of opportunity development and promote the sustainability of the digital entrepreneurial ecosystem.

Keywords: digital entrepreneurship ecosystem embeddedness; user entrepreneurship; entrepreneurial opportunity development; knowledge dynamic capabilities; entrepreneurial learning



Citation: Zhou, J.; Cen, W. Digital Entrepreneurial Ecosystem Embeddedness, Knowledge Dynamic Capabilities, and User Entrepreneurial Opportunity Development in China: The Moderating Role of Entrepreneurial Learning. *Sustainability* **2024**, *16*, 4343. <https://doi.org/10.3390/su16114343>

Academic Editors: Ming-Tsang Lu, Jung-Fa Tsai, Yi-Chung Hu and Ming-Hua Lin

Received: 8 March 2024

Revised: 1 May 2024

Accepted: 20 May 2024

Published: 21 May 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

In recent years, digital technologies such as big data, cloud services, artificial intelligence, and blockchain have profoundly reshaped the entrepreneurial model and industry pattern, and expanded entrepreneurial opportunities for entrepreneurs. Against the background of digital economy and China's policy call for "mass entrepreneurship and innovation", China's user entrepreneurial activities have been increasing [1]. Supported by digital technologies, digital user entrepreneurship has experienced explosive growth, with platforms such as Jittery, Pinduoduo, Xiaohongshu, and BeiliBili rapidly becoming leaders in China. Digital technologies have rebuilt the entrepreneurial environment, leading to the formation of a digital entrepreneurial ecosystem [2]. This ecosystem consists of a variety of entities and elements that act as a dynamic system driven by digital technologies, centered on entrepreneurial activities, and facilitates cooperative symbiosis among

digital startups, digital users, governments, universities, and research institutions [3,4]. Digital entrepreneurship ecosystem embeddedness refers to the degree of relationship and dependency that is formed between digital entrepreneurial firms and other members of that ecosystem (e.g., users, partners, government, etc.) [5]. This embeddedness is mainly reflected in the structural and relational aspects between the firm and other members of the ecosystem. Among them, structural embeddedness relates to the firm's position in the ecosystem and the way it is connected, and relational embeddedness refers to the interaction and cooperative relationship between the firm and other members. The larger and richer the ecosystem size, the richer the type, and the more central the user entrepreneur's position in the ecosystem, the easier it is to realize entrepreneurial opportunity development [5,6]. In addition, relational network embedding strengthens the relational bonds among members in the ecosystem, increases trust among members, broadens information exchange channels, and facilitates the transfer and acquisition of tacit knowledge, thus improving the quality and efficiency of opportunity development [7–9]. Therefore, it is necessary to examine the impact of digital entrepreneurship ecosystem embeddedness on entrepreneurial opportunity development.

User entrepreneurship is defined as the process by which users take the initiative to innovate and commercialize existing products or services in the market because they do not meet their existing needs [10]. User entrepreneurship is often the opposite of traditional entrepreneurship in that opportunities are not identified first, but rather existing products and services are modified to create innovations that are later identified as business opportunities [11]. User entrepreneurs often lack knowledge of operations and organizational management, but are more capable of entrepreneurial learning and product innovation than non-user entrepreneurs, and are more passionate about entrepreneurship, which is strengthened by solving demand problems [12,13]. At the same time, embedded digital entrepreneurship ecosystems can provide user entrepreneurs with the necessary resources for their survival and development, such as knowledge, skills, capital, technology, and other entrepreneurial resources [8,14], which prompts user entrepreneurs to improve their products and innovate their services in accordance with the market demand, and reduces the risk of entrepreneurial uncertainty [9].

Entrepreneurial opportunity development is a dynamic process of identifying, evaluating, and capitalizing on potential business opportunities [15]. It depends on the interaction between the entrepreneur and the internal and external environment [4,15]. Changes in intrinsic system elements such as user cognitive modes and prior knowledge, and extrinsic system elements such as resource sharing, network participation, and transfer evolution in the collaborative process of digital entrepreneurial ecosystems have been found to be important factors in triggering entrepreneurial opportunity development [2,6,8]. Since the transformation of user cognitive patterns and original knowledge is influenced by entrepreneurial learning behaviors and dynamic knowledge capabilities, the digital entrepreneurship ecosystem and knowledge dynamic capabilities become the key factors influencing the development of opportunities. Knowledge acquisition capability is the ability of user entrepreneurs to acquire external knowledge, assimilate it, and apply it to new business purposes [16]. Knowledge sharing capability, on the other hand, refers to the ability of user entrepreneurs to share the knowledge and experience they possess with others, facilitating knowledge flows, collaboration, and co-learning [17]. Digital entrepreneurship ecosystem embeddedness impacts entrepreneurs' knowledge acquisition, creation, sharing, and integration capabilities through various elements, structures, relationships, and mechanisms, thereby promoting entrepreneurial opportunity development [7,9,18].

However, digital entrepreneurial ecosystem embeddedness does not unconditionally drive users' entrepreneurial opportunity development, and its effect depends on knowledge dynamic capabilities and entrepreneurial learning behaviors. It has been found that the stronger the entrepreneurial learning behaviors, the stronger the knowledge dynamic capabilities, and the higher the level of tapping, prying, and utilizing the digital entrepreneurial ecosystem, the better the effect of driving entrepreneurial opportunity

development [13,19–21]. Drawing on the theory of dynamic capabilities, knowledge dynamic capabilities help users break path dependency and core rigidity by dynamically adjusting their knowledge base and structure, enabling them to identify and seize new market and technology opportunities. By embedding in digital entrepreneurial ecosystems, user entrepreneurs can dynamically integrate, share, and apply entrepreneurial knowledge to enhance knowledge acquisition and sharing capabilities, thereby improving overall knowledge dynamic capabilities and facilitating the development of entrepreneurial opportunities [7,21]. Therefore, it is imperative to investigate the mechanism of user entrepreneurship opportunity development from the perspective of entrepreneurial ecosystem and knowledge dynamic capabilities to enrich the content of user entrepreneurship research.

From a theoretical perspective, the concept of digital entrepreneurial ecosystems has gradually attracted the attention of innovation and entrepreneurship research and has triggered a wave of pioneering studies. However, the field is still in its infancy and lags behind practical developments. Existing studies mainly focus on theoretical analysis and case studies to explore the process and mechanism of entrepreneurial opportunity development in the digital context [2,7,8], and examine the factors of users' entrepreneurial opportunity development from the perspectives of industry attributes, users' identity characteristics, and open interactions [10,12,14], but there are fewer empirical studies on the mechanism of users' entrepreneurial opportunity impacts from entrepreneurial theoretical perspectives such as digital entrepreneurship ecosystem embeddedness and the capabilities of entrepreneurs [7,13,18,21]. Therefore, in order to gain a deeper understanding of the driving mechanism of digital entrepreneurial ecosystem embeddedness on user entrepreneurial opportunity development, this study utilizes the theory of entrepreneurial ecosystems and knowledge dynamic capabilities. Using hierarchical regression analysis and bootstrap methodology, the relationship between digital entrepreneurial ecosystem embeddedness, knowledge acquisition capability, knowledge sharing capability, and user entrepreneurial opportunity development is empirically examined. This study contributes to enriching the theoretical research in the field of digital entrepreneurship ecosystems, digital entrepreneurship, and user entrepreneurial opportunity. In addition, it provides practical insights into how user entrepreneurs in the digital economy can promote the sustainability of their startups and contribute to the sustainability goals of digital entrepreneurship ecosystems.

The structure of the paper is as follows. First, we conduct a literature review on topics such as digital entrepreneurial ecosystem embeddedness, user entrepreneurial opportunity development, knowledge dynamic capabilities, and entrepreneurial learning. Based on relevant theories, we propose our research hypotheses. Second, we elaborate on the research methodology, including the data collection process and variable measurements. Third, we present the empirical results. Fourth, we discuss the consistency, differences, or complementary aspects of our findings with existing research. Finally, we outline the research conclusions, discuss the theoretical and practical implications of our study, and suggest directions for future research.

2. Literature Review and Research Hypotheses

2.1. Digital Entrepreneurial Ecosystem Embeddedness and User Entrepreneurial Opportunity Development

Sussan and Acs [3] first proposed that the digital entrepreneurship ecosystem combines the characteristics of the entrepreneurial ecosystem and the digital ecosystem, and is a collection of digital infrastructure governance, digital users, digital entrepreneurship, and the digital market. The digital ecosystem is constructed by digital technology and heterogeneous digital entities, with the needs of digital users as the core, and digital products and services are created, disseminated, and connected by digital technology [3,22]. The entrepreneurial ecosystem is a complex system that can support entrepreneurship and promote resource sharing. The digital entrepreneurial ecosystem not only inherits the convergence, expansibility, and modularity of the digital ecosystem, but also has the diversity, network, symbiosis, competitiveness, and self-maintenance of the entrepreneurial

ecosystem [8,23]. This combination provides rich internal resources and mechanisms for the embeddedness of the digital entrepreneurial ecosystem, making it a powerful promoter of entrepreneurial opportunity development [21,24]. According to the theory of entrepreneurial ecosystems, entrepreneurial activity is not only an individual behavior, but also influenced by many factors such as environment, resources, network, and system. Under this theoretical framework, the embeddedness of digital entrepreneurial ecosystem is regarded as an important external factor, which has a potential positive impact on the development of users' entrepreneurial opportunities.

Digital entrepreneurship ecosystem embeddedness has triggered the reorganization and optimization of the "supply–demand" relationship, embodying the characteristics of diversity, networking, and symbiosis as outlined in entrepreneurship ecosystem theory. Through features such as digital technology transformation, open collaboration among all users, cross-border integration disruption, creation of high digital value, and dynamic rapid iteration, the embeddedness has reshaped the traditional formation of entrepreneurial opportunities, intensifying the relationship between "supply" and "demand". This reorganization and optimization have created favorable conditions for the emergence of more entrepreneurial opportunities [2,22,25]. Furthermore, digital entrepreneurship ecosystem embeddedness has accelerated the speed of identifying, evaluating, and validating entrepreneurial opportunities, aligning with the principle of rapid iteration in entrepreneurship ecosystem theory. The openness and availability features have shortened the distance between upstream and downstream in the industry chain, bringing businesses closer to customers. This not only facilitates the rapid emergence of entrepreneurial opportunities but also contributes to their rapid evolution [7,26]. The embeddedness has altered the traditional model of entrepreneurial opportunity development, fostering a new pattern more suited to the rapidly changing demands of the digital market. Moreover, it has provided rich resource support for entrepreneurial opportunity iteration, reflecting the resource-sharing characteristic of entrepreneurship ecosystem theory. By enhancing transparency, it enables enterprises to identify, search, and obtain entrepreneurial resources at lower costs, expanding the scope of alternative resources and improving the efficiency of resource acquisition and utilization, thus providing robust support for the efficient development of entrepreneurial opportunities [3,13]. Consequently, the following hypothesis is proposed:

H1. *Digital entrepreneurship ecosystem embeddedness has a positive impact on user entrepreneurial opportunity development.*

2.2. Digital Entrepreneurial Ecosystem Embeddedness and Knowledge Dynamic Capability

In the context of digital entrepreneurship ecosystems, it comprises a system consisting of digital enterprises, digital users, digital enterprise service agencies, government departments, and related industries [2]. Within these ecosystems, dynamic knowledge capabilities represent the process by which enterprises acquire and apply knowledge, serving as a core factor for maintaining competitive advantages in the digital era [7,26]. Emphasizing knowledge as a critical strategic resource for aiding organizations in gaining competitive advantages, the knowledge-based view posits that organizations are knowledge-bearing units and enhance their performance through knowledge creation [27,28]. However, the dynamic capabilities theory contends that relying solely on strategic resources is insufficient to ensure sustained competitive advantages, necessitating effective management practices. Therefore, scholars have proposed knowledge-based dynamic capabilities based on the knowledge-based view and dynamic capabilities theory. These capabilities refer to the high-order heterogeneous abilities of organizations to perceive, explore, and address environmental dynamics by acquiring, creating, and integrating knowledge. They are deconstructed into knowledge acquisition, knowledge generation, and integration capabilities [27,29]. Gonzalez [30] and Schulz [31] argue that two knowledge dynamic capabilities relevant to innovation and entrepreneurship are knowledge acquisition and knowledge sharing capabilities. These dynamic capabilities encompass the abilities to

acquire, integrate, share, and utilize knowledge. Knowledge acquisition capabilities provide entrepreneurs with new knowledge resources, while knowledge sharing capabilities ensure the comprehensive utilization and integration of these knowledge resources within entrepreneurs, mutually enhancing the overall knowledge dynamic capabilities.

Drawing from embeddedness theory, digital entrepreneurship ecosystem embeddedness encompasses structural, relational, and cognitive dimensions [32,33]. Firstly, structural embeddedness refers to the connections and dependencies between firms and other organizations within the digital entrepreneurial ecosystem. Resources such as digital platforms and digital enterprise service organizations in the digital entrepreneurial ecosystem provide channels and opportunities for firms to acquire knowledge. Through connections with these organizations, firms can access external knowledge resources and enhance their knowledge acquisition capabilities [7,22]. Additionally, structural embeddedness in the digital entrepreneurial ecosystem can also facilitate knowledge integration and application. Firms can integrate knowledge from different domains through collaboration and co-innovation with other organizations, thereby creating new knowledge and value. Secondly, relational embeddedness refers to the collaboration and partnership between firms and other organizations within the digital entrepreneurial ecosystem. The collaborative efforts among various stakeholders such as digital enterprises, digital platforms, and digital enterprise service organizations in the digital entrepreneurial ecosystem can promote knowledge sharing and co-innovation [26,34]. By establishing close and highly trusted partnerships with these organizations, firms can share and exchange knowledge, gaining innovative ideas and experiences from other organizations. This relational embeddedness of knowledge sharing and co-innovation contributes to enhancing firms' dynamic capabilities.

Finally, cognitive embeddedness refers to firms' cognition and understanding of the digital entrepreneurial ecosystem. Core digital enterprises in the digital entrepreneurial ecosystem promote the formation of cognitive embeddedness by disseminating digital innovation concepts and updating strategic cognition, facilitating the formation of a favorable culture and atmosphere for innovation and entrepreneurship among users within the digital entrepreneurial ecosystem. This enables users to better adapt to and understand environmental changes, thereby enhancing their dynamic capabilities [2,8,34]. In summary, structural embeddedness provides opportunities for knowledge acquisition and integration, relational embeddedness promotes knowledge sharing and co-innovation, and cognitive embeddedness enhances firms' adaptive capabilities to environmental changes. These embeddedness mechanisms are interrelated and mutually influential, collectively promoting the enhancement of dynamic capabilities among user entrepreneurial firms. Hence, the following hypotheses are proposed:

H2. *Digital entrepreneurship ecosystem embeddedness positively influences knowledge dynamic capabilities.*

H2a. *Digital entrepreneurship ecosystem embeddedness positively influences knowledge acquisition capabilities.*

H2b. *Digital entrepreneurship ecosystem embeddedness positively influences knowledge sharing capabilities.*

2.3. Knowledge Dynamic Capabilities and User Entrepreneurial Opportunity Development

In the investigation of digital entrepreneurial ecosystem, it is imperative to delve into the impact of knowledge dynamic capabilities on user entrepreneurial opportunity development, particularly considering the synergistic effect of knowledge-based views and dynamic capabilities. Compared to the singular application of these two theoretical frameworks, their collaborative formation of knowledge dynamic capabilities has been proven to significantly enhance organizational competitiveness, manifested in superior product and service quality, broader customer base, higher market share, and profitability [35,36]. Specif-

ically, the acquisition and management of market knowledge and customer knowledge play a crucial mediating role between market orientation and innovative entrepreneurial opportunity development, underscoring the importance of knowledge dynamic capabilities in digital entrepreneurial ecosystems. By more effectively acquiring, sharing, and leveraging knowledge, user entrepreneurs can gain deeper insights into market dynamics, thereby better exploiting entrepreneurial opportunities and creating new products to meet customer and market demands [37,38]. In the process of constructing digital entrepreneurial networks, the significance of knowledge sharing capabilities gradually becomes prominent. Companies with robust knowledge sharing capabilities can establish a good reputation in business exchanges, thereby helping user entrepreneurs attract more potential business partners and drive innovative development [7,22].

Conversely, user entrepreneurial enterprises lacking sufficient knowledge sharing capabilities may struggle to achieve their anticipated innovative outcomes, as they might miss out on opportunities for external knowledge sharing, thereby impacting the realization of internal knowledge potential. Therefore, knowledge dynamic capabilities in digital entrepreneurial ecosystem are not only the source of enterprise competitiveness but also the driving force for innovation in entrepreneurial opportunity development [28,39]. Furthermore, it is essential to consider the dissemination and utilization of other innovation assets among platform ecosystem members. By supporting the dissemination and utilization of technological, procedural, and intellectual property innovation assets among platform ecosystem members, knowledge dynamic capabilities can be fully leveraged, further reducing the knowledge gap in discovering and exploiting potential opportunities, influencing the iterative manner of opportunities and expanding the direction of opportunity sets [21,24]. Additionally, in digital entrepreneurial ecosystems, by better sharing and utilizing knowledge, enterprises can establish tightly knit, highly trusted partner relationships, which contribute to expanding heterogeneous resource sets and forming richer and more diverse opportunity sets [3,22]. Knowledge dynamic capabilities, through facilitating knowledge flow within the ecosystem, contribute to the formation of broader and more innovative entrepreneurial opportunities, providing user entrepreneurs with a more extensive development space. Therefore, the following hypotheses are proposed:

H3. *There is a positive impact between knowledge dynamic capabilities and user entrepreneurial opportunity development.*

H3a. *Knowledge acquisition capability has a positive impact on user entrepreneurial opportunity development.*

H3b. *Knowledge sharing capability has a positive impact on user entrepreneurial opportunity development.*

2.4. The Mediating Role of Knowledge Dynamic Capabilities

Dynamic capability in knowledge involves continuously acquiring, integrating, and applying knowledge for innovation and entrepreneurship. Key to this are knowledge acquisition and sharing abilities. Knowledge acquisition enables enterprises to update and enrich their knowledge base, facilitating timely access to new knowledge resources. Meanwhile, knowledge sharing ensures dissemination, fostering integration and innovation. Digital entrepreneurship ecosystem embeddedness influences user entrepreneurial opportunity development by impacting knowledge acquisition. This embeddedness, through entrepreneurial networks and collaborative mechanisms, facilitates diverse and effective support for knowledge acquisition [7,22,26]. Entrepreneurial networks, as social relationship collections, provide crucial resources and impetus for entrepreneurs and startups. Through structural, relational, and cognitive embedding, the ecosystem evolves, enhancing support for knowledge acquisition and fostering information flow, promoting knowledge accumulation and sharing [26,40]. Additionally, collaborative embeddedness mechanisms,

fundamental for multi-party collaboration in digital entrepreneurial ecosystems, establish effective linkages, providing cross-domain and cross-entity opportunities for knowledge acquisition, further facilitating diverse knowledge acquisition [3,22]. Leveraging knowledge acquisition capabilities, users connect entrepreneurs, enterprises, and other stakeholders, accessing necessary knowledge resources, innovating their models, and utilizing resources innovatively, thus identifying and developing more innovative entrepreneurial opportunities [1,3,40].

Through the sharing of knowledge, the digital entrepreneurial ecosystem facilitates the development of entrepreneurial opportunities by influencing the users' entrepreneurial capabilities. This research suggests that within this ecosystem, various actors collaboratively couple internal and external elements, with the participation of digital users being a central driving force. By sharing crucial knowledge, they provide significant support for identifying and developing entrepreneurial opportunities [7,18,26]. The coupling of digital entrepreneurial elements highlights the pivotal role of knowledge sharing, particularly the involvement of digital users, who integrate entrepreneurial elements within the system, offer insightful market trend assessments, and propose innovative digital solutions [2,6,41]. Digital incubators, as collaborative entities, facilitate the organic alignment of heterogeneous entrepreneurial elements, fostering the flow and aggregation of digital entrepreneurial components. Consequently, the mechanism of knowledge sharing renders the digital entrepreneurial ecosystem more flexible, promoting the influx of diverse elements and facilitating the value addition and cyclical flow of digital entrepreneurial components, thereby sustaining the development of entrepreneurial opportunities for users [25,42]. Therefore, the following hypotheses are proposed:

H4. *Knowledge dynamic capabilities mediate the relationship between digital entrepreneurship ecosystem embeddedness and entrepreneurial opportunity development.*

H4a. *Knowledge acquisition capability mediates between digital entrepreneurship ecosystem embeddedness and entrepreneurial opportunity development.*

H4b. *Knowledge sharing capability mediates between digital entrepreneurship ecosystem embeddedness and entrepreneurial opportunity development.*

2.5. The Moderating Effect of Entrepreneurial Learning

Politis proposed that entrepreneurial learning is commonly characterized as an ongoing process that facilitates the acquisition of essential knowledge required for proficiently initiating and managing new ventures [43]. It serves as a crucial moderator in the relationship between the embeddedness of the digital entrepreneurial ecosystem and the capabilities of knowledge acquisition and sharing. Entrepreneurial learning comprises three main components: entrepreneurs' career experience, the transformation process, and entrepreneurial knowledge, which are essential for enhancing the knowledge acquisition and sharing capabilities of user entrepreneurs and are pivotal for identifying and leveraging entrepreneurial opportunities [41,43,44].

The interaction between the embeddedness of the digital entrepreneurship ecosystem and entrepreneurial learning has a significant impact on knowledge acquisition and sharing capabilities. Entrepreneurs' career experiences within the ecosystem foster their cognitive learning, enhancing their ability to acquire knowledge [43]. As a repository of knowledge resources, the digital entrepreneurial ecosystem provides ample learning pathways. Entrepreneurs assimilate experiences from successful peers, thereby enhancing their capacity to leverage ecosystem resources. Furthermore, the inherent transformation process in entrepreneurial learning facilitates the conversion of these experiences into actionable entrepreneurial knowledge [13,42,43]. Practical learning, facilitated by the embeddedness of the digital entrepreneurship ecosystem, strengthens entrepreneurs' knowledge sharing capabilities [26,44]. Through ecosystem embeddedness, newly acquired knowledge and

experiences find pathways for dissemination. Serving as a hub for information exchange, the embeddedness of the digital entrepreneurial ecosystem promotes active participation in knowledge sharing, thereby enriching channels for collaborative learning among entrepreneurs [27,29]. The reinforcement of entrepreneurial learning strengthens the support provided by the embeddedness of the digital entrepreneurship ecosystem for knowledge acquisition and sharing among entrepreneurs, thereby facilitating knowledge flow and dissemination within the ecosystem [26,45].

Entrepreneurial learning enhances entrepreneurs' capabilities in knowledge acquisition and sharing [44], enabling them to better harness the potential of the digital entrepreneurship ecosystem. First, strengthening entrepreneurial learning enables users to gain a deeper understanding of the operational dynamics and underlying mechanisms of the digital entrepreneurship ecosystem, thereby enhancing their proficiency in utilizing digital entrepreneurship elements and expanding their knowledge acquisition abilities [7,8]. Through continuous learning and experience accumulation, entrepreneurs gain insights into market trends, technological advancements, and emerging business models, enabling effective identification and seizing of entrepreneurial opportunities, thereby driving the development of digital entrepreneurial endeavors [13,36].

Additionally, entrepreneurial learning fosters the cultivation of entrepreneurs' knowledge sharing capability. Within the embeddedness of the digital entrepreneurship ecosystem, various stakeholders collaborate to promote user innovation and entrepreneurship [22,45]. Entrepreneurial learning empowers entrepreneurs to actively engage in collaboration and communication within the digital entrepreneurship ecosystem, facilitating knowledge sharing and cooperation with digital entrepreneurial enterprises, government agencies, academic institutions, and research entities [26,36]. The enhancement of knowledge sharing proficiency strengthens the synergistic interaction among various elements within the digital entrepreneurship ecosystem, promoting the linkage and flow of digital entrepreneurship elements [8,36,45]. Therefore, the enhancement of entrepreneurial learning capabilities corresponds to the strengthening of entrepreneurs' abilities to efficiently acquire and utilize various resources within the digital entrepreneurship ecosystem, thereby accelerating the improvement of knowledge acquisition and sharing capabilities and continually driving the discovery and development of entrepreneurial opportunities [35,43,46]. Consequently, the following hypotheses are proposed:

H5. *Entrepreneurial learning positively moderates the impact of digital entrepreneurship ecosystem embeddedness on knowledge dynamic capabilities.*

H5a. *Entrepreneurial learning positively moderates the impact of digital entrepreneurship ecosystem embeddedness on knowledge acquisition capability.*

H5b. *Entrepreneurial learning positively moderates the impact of digital entrepreneurship ecosystem embeddedness on knowledge sharing capability.*

Based on the above, the theoretical model constructed in this study is illustrated in Figure 1.

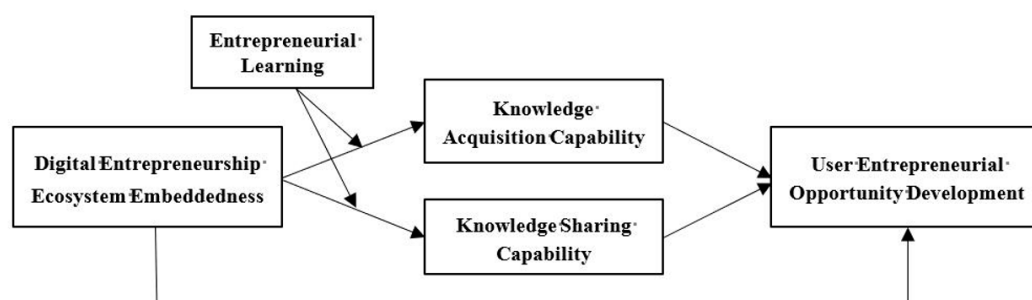


Figure 1. Theoretical framework.

3. Materials and Methods

3.1. Sample and Data Collection

Before distributing the questionnaires, this study conducted a preliminary exploration to identify potential participants. Through a series of interviews, it was found that founders, middle, and senior managers of user startups situated in digital entrepreneurship incubation centers and high-tech entrepreneurship parks possess valuable insights into their enterprise's embeddedness in the digital entrepreneurship ecosystem and their knowledge acquisition and sharing capabilities. Therefore, these individuals were targeted as the primary participants for this study.

To ensure the representativeness of the sample, the selection process followed a stratified approach. Firstly, user entrepreneurial companies located in regions with relatively developed digital economy and stationed in innovation and entrepreneurship ecosystem platforms and incubation bases were identified as target enterprises. Consequently, user entrepreneurs stationed in digital entrepreneurship incubation centers, high-tech entrepreneurial parks, university entrepreneurial parks, and other relevant locations were included in this study. The survey was distributed in digitally developed cities across China, including Beijing, Shanghai, Hangzhou, Shenzhen, Guangzhou, Nanjing, and others. The selection of cities aimed to capture the diverse representation of the digital entrepreneurship landscape. Additionally, to cover a wide range of entrepreneurial activities, this study also included entrepreneurs from different industries such as internet technology, cultural arts, sports, and rehabilitation. This approach ensured that the sample contained diverse viewpoints and experiences.

The data collection process utilized multiple channels, including online questionnaires, platforms such as Questionnaire Star, WeChat links, and offline randomized distribution to user startup founders, middle, and senior managers. Furthermore, individual entrepreneurs directly or indirectly involved in entrepreneurial activities, such as university students, employees, community workers, freelancers, etc., were included based on their product demand and participation in entrepreneurship. The diverse selection ensured the representativeness and feasibility of the sample. Data collection took place from October 2023 to January 2024, with a total of 296 questionnaires collected. User entrepreneurs were identified by setting the question "Did you start your business because you were dissatisfied with the product or service?" and excluding questionnaires with high regularity and short completion time. Finally, valid data from 232 user entrepreneurial companies were obtained, with a valid questionnaire rate of 78.38%. The distribution of the sample is shown in Table 1.

In this study, we employed the ChatGPT 4.0 to polish the language of certain paragraphs in the article, such as the Introduction and Hypothesis Sections, with the aim of enhancing reader comprehension. ChatGPT 4.0 is an AI-based natural language processing tool capable of generating fluent text with good grammar and semantic understanding. The specific steps involved were as follows. First, paragraph selection: We identified the paragraphs requiring language refinement, primarily focusing on the Introduction and Hypothesis Sections. Second, text input: Subsequently, we input the text of these paragraphs into the ChatGPT 4.0. Third, language optimization: ChatGPT 4.0 automatically generated language that was clearer, more accurate, and easier to understand based on the input text. We further refined and modified the generated text by comparing it with the original text to ensure coherence and logic. Fourth, review and adjustment: we reviewed the text processed by ChatGPT 4.0 and made necessary tweaks and modifications to effectively enhance the language quality of the article.

Table 1. Distribution of samples.

Category	Classification	Sample Count (n = 232)	Percentage (%)	Category	Classification	Sample Count (n = 232)	Percentage (%)
Gender	Male	142	61	Entrepreneurship Duration	0–1 year	18	8
	Female	90	39		1–2 years	51	22
Age	30 and below	85	37		2–3 years	83	35
	31–40	94	41		3–4 years	46	20
	41–50	40	17		4 years and above	34	15
	Above 50	13	5				
Education	High school and below	14	6	Entrepreneurship Type	Cultural and artistic	13	6
	Associate’s	39	17		Food and beverage	33	14
	Bachelor’s	157	68		Internet technology	61	26
	Master’s and above	22	9		Logistics and distribution	18	8
Company Size	0–10	61	26		Sports and health	23	10
	11–20	72	31		Agricultural products	8	3
	21–30	46	20		Home decoration	16	7
	Above 30	53	23		Education and training	39	17
					Other	21	9

3.2. Variable Measurement

To ensure the reliability and validity of the measurement tools, authoritative scales from domestic and international scholars were utilized in this study. For the digital entrepreneurial ecosystem embeddedness, drawing upon the research of Nambisan and Baron [46] and Cao and Li [47], four items were selected, including “efficiently accessing, integrating, and utilizing various resources (technology, funds, information, etc.)”. Regarding knowledge dynamic capabilities, inspired by the works of Gold et al. [48] and Schulz [31], three items were chosen for knowledge acquisition capability, such as “continuously acquiring the knowledge needed to start a business from customers”, and four items for knowledge sharing capability, such as “ability to continuously share knowledge with customers”. For entrepreneurial opportunity development, following the research of Samuelsson [49] and Long et al. [50], four items were selected, including “the products or services initiated by oneself are unique in the market”. As for entrepreneurial learning, inspired by the studies of Politis [43] and Shan et al. [51], six items were chosen, such as “previous experiences are important references for decision-making in entrepreneurial activities”. All variables were measured using a Likert 5-point scale, ranging from 1 “strongly disagree” to 5 “strongly agree”. Specific items are presented in Table 2.

Table 2. Reliability and validity (n = 232).

Variable	Items	Factor Loading
Digital Entrepreneurial Ecosystem Embeddedness (DEE) ($\alpha = 0.827$, CR = 0.842, AVE = 0.571)	1. Efficiently accessing and utilizing various resources (technology, funds, information, etc.).	0.798
	2. Optimizing the position and role of the enterprise in the entire ecosystem.	0.771
	3. Closely interacting and collaborating with other key elements (such as partners, investors).	0.686
	4. Continuously improving the level of digital technology application in entrepreneurial activities.	0.764
Knowledge Acquisition Capability (KAC) ($\alpha = 0.833$, CR = 0.815, AVE = 0.596)	1. Continuously acquiring the knowledge needed to start a business from customers.	0.765
	2. Continuously acquiring knowledge from external partners for startups.	0.767
	3. Ability to continuously utilize customer and external partner feedback and acquired knowledge resources to improve subsequent products/services.	0.783
Knowledge Sharing Capability (KSC) ($\alpha = 0.889$, CR = 0.846, AVE = 0.579)	1. Ability to continuously share knowledge with customers.	0.760
	2. Ability to continuously share knowledge with external partners.	0.793
	3. Capability for sustained and effective knowledge sharing within the entire organization.	0.764
	4. Ability to sustain knowledge sharing among all parties involved in new product/service development.	0.726
User Entrepreneurial Opportunity Development (EOD) ($\alpha = 0.845$, CR = 0.832, AVE = 0.553)	1. The products or services initiated by oneself are unique in the market.	0.741
	2. The products or services initiated by oneself face little competitive pressure.	0.763
	3. The products or services initiated by oneself are novel compared to the existing market.	0.756
	4. The products or services initiated by oneself can cater to emerging markets.	0.715
Entrepreneurial Learning (EL) ($\alpha = 0.789$, CR = 0.864, AVE = 0.515)	1. Previous experience is an important reference for decision-making in entrepreneurial activities.	0.717
	2. Continuously summarizing and reflecting on previous behaviors is beneficial for gaining experience.	0.732
	3. Paying attention to the behaviors of “benchmark” enterprises and successful entrepreneurs in the same industry.	0.741
	4. Regularly communicating with professionals in the industry.	0.697
	5. Continuous practice is effective in responding to changes in the external environment.	0.748
	6. Deepening the understanding of entrepreneurship continuously in entrepreneurial practice.	0.668

4. Results

4.1. Measurement Reliability and Validity

In this study, reliability and validity tests of the variables were conducted using SPSS 27.0 and Amos 25.0 software, as shown in Table 2. According to the reliability test results, the Cronbach’s α values for all variables were above 0.7, and the CR values were above 0.8, indicating good reliability of the scales used. Regarding the validity test results, all factor

loadings of the items were above 0.6, and the Average Variance Extracted (AVE) values were above 0.5, suggesting good convergent validity of the variables' scales. The structural validity and discriminant validity of the five-factor model and the differences between variables were examined using fit indices including χ^2/df , RMSEA, SRMR, CFI, and TLI. Table 3 demonstrates that the fit indices of the five-factor model were significantly better than other factor combinations. Additionally, the square root of each variable's AVE was greater than its correlation with other variables, indicating a high discriminant validity among the variables in the five-factor model.

Table 3. Results of confirmatory factor analysis.

Model	χ^2/df	RMSEA	SRMR	CFI	TLI
Five-factor model: DEE, KAC, KSC, EOD, EL	2.239	0.071	0.043	0.928	0.917
Four-factor model: DEE, KAC + KSC, EOD, EL	2.889	0.092	0.051	0.913	0.878
Three-factor model: DEE + EL, KAC + KSC, EOD	3.271	0.107	0.073	0.874	0.862
Two-factor model: DEE + EL, KAC + KSC + EOD	4.849	0.145	0.078	0.795	0.783
Single-factor model: DEE + KAC + KSC + EOD + EL	6.234	0.153	0.084	0.768	0.742

Note: DEE, KAC, KSC, EOD, and EL represent digital entrepreneurial ecosystem embeddedness, knowledge acquisition capability, knowledge sharing capability, entrepreneurial opportunity development, and entrepreneurial learning, respectively. Same below.

4.2. Common Method Variance

This study employed both pre-control and post-control methods to mitigate the risk of common method bias. For pre-control, anonymous surveys were conducted, and multiple items measuring latent variables of different types and sources were designed. Additionally, techniques such as changing the order of items were utilized to reduce artificial covariance. Regarding post-control, Harman's single-factor test was employed. Exploratory factor analysis revealed the presence of five factors with eigenvalues greater than 1. However, the variance explained by the largest factor was 23.568%, which did not exceed 40%, indicating the absence of significant common method bias issues.

4.3. Correlation Analysis

As shown in Table 4, the correlation coefficients between all the core variables are less than 0.7, indicating that there is no serious problem of multicollinearity. The covariance diagnostic results also show that the Variance Inflation Factors (VIFs) of all variables are between 1.018 and 1.693, which is far below the threshold of 10, further confirming that there is no potential multicollinearity problem between the independent variables and the mediating and moderating variables. In addition, digital entrepreneurship ecosystem embeddedness is positively correlated with knowledge acquisition capacity and knowledge sharing capacity ($\beta = 0.334$, $p < 0.01$; $\beta = 0.465$, $p < 0.01$), and knowledge acquisition capacity and knowledge sharing capacity are positively correlated with user entrepreneurial opportunity development ($\beta = 0.415$, $p < 0.01$; $\beta = 0.422$, $p < 0.01$), and the correlation coefficients of the variables are all less than the AVE square root, providing initial support for further regression studies.

Table 4. Correlation and discriminant validity (n = 232).

Construct	Mean	SD	DEE	KAC	KSC	EOD	EL
DEE	3.705	0.829	0.756				
KAC	3.534	0.925	0.334 **	0.772			
KSC	3.563	0.916	0.465 **	0.528 **	0.761		

Table 4. Cont.

Construct	Mean	SD	DEE	KAC	KSC	EOD	EL
EOD	3.708	0.815	0.306 **	0.415 **	0.422 **	0.744	
EL	3.628	0.863	0.266 **	0.331 **	0.323 **	0.557 **	0.718

Note: ** At the 0.01 level (two-tailed), the correlation is significant; diagonal values represent the square root of AVE for the corresponding variables.

4.4. Hypothesis Testing

This study used hierarchical regression analyses using SPSS 27.0 to test the hypotheses of the research model, and the results are presented in Table 5. Model 1 represents the regression model of control variables on dynamic knowledge capabilities, while Models 2 and 3 represent regression models of the two dimensions of dynamic knowledge capabilities and digital entrepreneurship ecosystem embeddedness, respectively. Firstly, it was observed that the R^2 of Models 2 and 3 significantly increased compared to Model 1, indicating better model fit. Secondly, the coefficients of Models 2 and 3 with digital entrepreneurship ecosystem embeddedness were significantly positive ($\beta = 0.460$, $p < 0.001$; $\beta = 0.516$, $p < 0.001$), indicating a positive effect of digital entrepreneurship ecosystem embeddedness on knowledge acquisition and knowledge sharing capabilities, supporting H2a and H2b and thereby confirming H2.

Table 5. Regression models and results.

Variable Category	Variable Name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Control Variables	Age	0.038	0.037	0.026	0.017	0.122	0.108	0.120
	Education	0.077	0.065	0.068	0.054	0.057	0.060	0.071
	Entrepreneurship Duration	−0.079	−0.116	−0.110	−0.093	−0.113	−0.118	−0.131
	Entrepreneurship Type	0.031	0.019	0.037	0.042	0.056	0.067	0.046
Independent Variable	DEE		0.460 ***	0.516 ***		0.475 ***		0.322 **
Mediating Variable	KAC						0.248 ***	0.213 ***
	KSC						0.374 ***	0.281 ***
	R^2	0.068	0.238	0.453	0.085	0.347	0.521	0.457
	F	2.586 ***	18.391 ***	27.668 ***	2.765 ***	9.348 ***	48.173 ***	38.342 ***

Note: ** $p < 0.01$, *** $p < 0.001$ two tailed.

Model 4 represents the regression model of control variables on user entrepreneurial opportunity development, while Model 5 represents the regression model of user entrepreneurial opportunity development with digital entrepreneurship ecosystem embeddedness. The regression coefficients in both models were significantly positive ($\beta = 0.475$, $p < 0.001$), indicating a significant positive effect of digital entrepreneurship ecosystem embeddedness on user entrepreneurial opportunity development, thereby supporting hypothesis H1.

The results of Model 6 demonstrate that the regression coefficients of user entrepreneurial opportunity development with the two dimensions of dynamic knowledge capabilities were significantly positive ($\beta = 0.248$, $p < 0.001$; $\beta = 0.374$, $p < 0.001$), indicating a positive influence of knowledge acquisition and knowledge sharing capabilities on user entrepreneurial opportunity development, verifying H3a and H3b and thereby confirming H3.

Model 7 represents the full regression model of control variables, digital entrepreneurship ecosystem embeddedness, and the two dimensions of dynamic knowledge capabilities on user entrepreneurial opportunity development, aimed at testing the mediating effect of dynamic knowledge capabilities. Compared to Model 5, after including the mediat-

ing variables, both knowledge acquisition ($\beta = 0.213, p < 0.001$) and knowledge sharing capabilities ($\beta = 0.281, p < 0.001$) significantly positively influenced user entrepreneurial opportunity development, while digital entrepreneurship ecosystem embeddedness still significantly positively influenced user entrepreneurial opportunity development ($\beta = 0.322, p < 0.01$), though with slightly reduced significance, indicating that knowledge acquisition and knowledge sharing capabilities partially mediate the relationship between digital entrepreneurship ecosystem embeddedness and user entrepreneurial opportunity development. Moreover, using the bootstrap method to conduct a robustness test of the mediating effects of knowledge acquisition and knowledge sharing capabilities, with 5000 repetitions at a 95% confidence level, the mediation effect coefficient of knowledge acquisition was 0.148, with a confidence interval of [0.106, 0.214], and the mediation effect coefficient of knowledge sharing capabilities was 0.276, with a confidence interval of [0.137, 0.348], both excluding 0, indicating that knowledge acquisition and knowledge sharing capabilities mediate the relationship between digital entrepreneurship ecosystem embeddedness and user entrepreneurial opportunity development. Thus, hypotheses H4a and H4b are supported, confirming H4. At the same time, the significant difference between the two paths was -0.128 , with a confidence interval of [0.031, 0.134], not including 0, indicating that knowledge sharing capabilities serve as the superior mediating path.

The results of the moderation effect of entrepreneurial learning are presented in Table 6. The findings indicate that the interaction term between digital entrepreneurial ecosystem embeddedness and entrepreneurial learning ($\beta = 0.131, p < 0.01$) is significantly positively associated with knowledge acquisition capability. Moreover, the impact of digital entrepreneurial ecosystem embeddedness on knowledge acquisition capability is significantly higher in high entrepreneurial learning contexts ($\beta = 0.524, p < 0.001$) compared to low entrepreneurial learning contexts ($\beta = 0.326, p < 0.001$). Additionally, the interaction term between digital entrepreneurial ecosystem embeddedness and entrepreneurial learning ($\beta = 0.172, p < 0.001$) positively influences knowledge sharing capability. Furthermore, the effect of digital entrepreneurial ecosystem embeddedness on knowledge sharing capability is significantly higher in high entrepreneurial learning environments ($\beta = 0.588, p < 0.001$) compared to low entrepreneurial learning environments ($\beta = 0.435, p < 0.001$). These findings confirm the positive moderating effect of entrepreneurial learning on the relationship between digital entrepreneurial ecosystem embeddedness and knowledge acquisition capability as well as knowledge sharing capability, validating H5a and H5b and thereby supporting H5.

Table 6. Test results of moderating effect of entrepreneurial learning.

Variable	Knowledge Acquisition Capability		Knowledge Sharing Capability	
	Estimate	Standard Error	Estimate	Standard Error
DEE	0.392 ***	0.061	0.437 ***	0.056
EL	0.226 ***	0.059	0.344 ***	0.041
DEE $\times$ EL	0.131 **	0.052	0.172 ***	0.036
EL (Low)	0.326 ***	0.065	0.435 ***	0.053
EL (High)	0.524 ***	0.081	0.588 ***	0.074

Note: ** $p < 0.01$, *** $p < 0.001$ two tailed.

4.5. Robustness Testing

Drawing on the tests of Baum and Lake [52], Wang and Shao [53], Young and Holsteen [54], and others, this study tested the robustness of the conclusions using two random sample draws, substitution of key variable measurements, and the addition of control variables. The results show that the empirical conclusions obtained are consistent with the original overall conclusions regardless of whether 90% or 60% of the subsamples are randomly selected; the robustness of the findings is tested by adopting different measure-

ment methods for the key variables of knowledge acquisition and knowledge sharing capability, and the results are consistent with the previous conclusions; and the magnitudes of some regression coefficients change after adding control variables, but their signs and the significance level basically remain consistent with the previous findings. Therefore, the conclusions of this study are robust. The specific test results are shown in Table 7.

Table 7. Results of robustness test.

Path	Original Results	60% Sample	90% Sample	Substitute Variable Measurement	Addition of Control Variables
DEE → EOD	0.475 ***	0.453 ***	0.461 ***	0.393 ***	0.479 ***
DEE → KAC	0.460 ***	0.358 ***	0.452 ***	0.477 ***	0.485 ***
DEE → KSC	0.516 ***	0.396 ***	0.491 ***	0.503 ***	0.521 ***
KAC → EOD	0.248 ***	0.196 ***	0.225 ***	0.221 ***	0.236 ***
KSC → EOD	0.374 ***	0.316 ***	0.358 ***	0.307 ***	0.319 ***
DEE × EL → KAC	0.131 **	0.129 **	0.148 **	0.120 **	0.137 **
DEE × EL → KSC	0.172 ***	0.153 ***	0.167 ***	0.165 ***	0.184 ***

Note: ** $p < 0.01$, *** $p < 0.001$ two tailed.

5. Discussion

Utilizing the digital entrepreneurial ecosystems embeddedness to continuously empower opportunity development is a crucial pathway for users to efficiently identify and develop digital entrepreneurial opportunities, create and access new value, form entrepreneurial competitive advantages, and drive the sustainability of digital entrepreneurial ecosystems. It also serves as a microfoundation for achieving deep integration between digital entrepreneurship and user entrepreneurship. In this regard, this study, based on the theories of entrepreneurial ecosystems and dynamic capabilities, employs hierarchical regression analysis and bootstrap methods to investigate the mechanism of digital entrepreneurial ecosystem embeddedness on user entrepreneurial opportunity development. Additionally, it analyzes the mediating role of knowledge acquisition and sharing capabilities, as well as the moderating effect of entrepreneurial learning. This research not only elucidates the impact mechanism of digital entrepreneurial ecosystem embeddedness on dynamic capabilities and user opportunity development but also expands the scope of research in entrepreneurship opportunities and digital entrepreneurship. Furthermore, it provides valuable insights into how digital entrepreneurial ecosystems can contribute to achieving sustainability goals. The key findings are as follows.

- (1) Digital entrepreneurial ecosystem embeddedness significantly promotes user entrepreneurial opportunity development. Digital entrepreneurial ecosystem embeddedness facilitates entrepreneurial users in expanding their online presence and enhancing networking relationships, aiding in the discovery, leveraging, and capitalization of the rich resources within digital entrepreneurial ecosystems [3,26]. This overcomes the resource constraints of individual entities and elements, constructed by a supportive combination, enabling them to enhance entrepreneurial opportunity development through interactions with multiple entities to acquire direct or indirect heterogeneous resources [8,26,55]. The impact of the digital divide on digital entrepreneurial ecosystem embeddedness and user entrepreneurial opportunity development is a widely discussed topic. Exploring how differences in accessing digital resources and technologies affect knowledge acquisition and sharing among entrepreneurial users can contribute to a more comprehensive understanding of ecosystem dynamics [3,56]. In our study, we found that digital entrepreneurial ecosystem embeddedness positively influences user entrepreneurial opportunity development. However, the digital divide may affect this process [57,58]. The digital divide refers to differences between regions, communities, or groups in accessing and utilizing digital technologies [58]. In

digital entrepreneurial ecosystems, the digital divide may lead to disparities among entrepreneurial users in accessing digital resources and technologies. Some regions or groups may face significant challenges due to a lack of widespread digital technology adoption or insufficient digital literacy levels [57]. This could result in lower levels of digital entrepreneurial ecosystem embeddedness, making it difficult for them to fully leverage the resources and opportunities within the system [3,59]. Therefore, addressing the digital divide is crucial. Governments, businesses, and social organizations can take measures to promote digital technology adoption and improve digital literacy levels, thereby narrowing the digital divide between different regions, communities, or groups [58,60]. Consequently, more entrepreneurial users will be able to fully participate in digital entrepreneurial ecosystems, achieve efficient knowledge acquisition and sharing, and develop entrepreneurial opportunities, thereby driving the sustainability and innovation of the entire digital entrepreneurial ecosystem.

- (2) Digital entrepreneurial ecosystem embeddedness promotes users' knowledge acquisition and knowledge sharing capability. Particularly, when entrepreneurial learning is heightened, it triggers and catalyzes users to collaborate with key members of digital entrepreneurial ecosystems and entrepreneurial networks [43,44]. This collaboration accelerates the acquisition, sharing, and integration of supply and demand information and knowledge, thereby enhancing overall knowledge dynamic capabilities. By incorporating an interdisciplinary perspective, especially from the fields of sociology, psychology, and information technology, we gain a more comprehensive understanding of the interaction between social norms, psychological factors, technological advancements, digital entrepreneurial ecosystem embeddedness, and knowledge dynamics [41,61]. This holistic understanding provides deeper insights, especially when exploring mechanisms for user entrepreneurial opportunity development [61]. Social norms play a crucial role in digital entrepreneurial ecosystems, shaping the behavior and decisions of entrepreneurial users, influencing their interactions with others in the ecosystem, as well as their acceptance of innovation and risk [62,63]. For instance, some social norms may encourage collaboration and information sharing, thereby fostering interaction among entrepreneurs and the exchange of resources. Psychological factors also influence the behavior of entrepreneurial users. Individual entrepreneurial motives, innovation awareness, and risk preferences affect their degree of participation and direction of action within the ecosystem [64,65]. In this context, heightened levels of entrepreneurial learning may further stimulate users to leverage digital entrepreneurial ecosystem embeddedness and collaborate with key members of entrepreneurial networks, accelerating the acquisition, sharing, and integration of supply and demand information and knowledge. This collaboration and knowledge sharing help entrepreneurial users better adapt to changes in the entrepreneurial ecosystem, thereby enhancing overall knowledge dynamic capabilities. Additionally, technological advancements drive the development and evolution of digital entrepreneurial ecosystems [42]. With continuous technological progress, new tools, platforms, and applications emerge, providing entrepreneurial users with more entrepreneurial opportunities and resources [26]. These technological advancements not only expand the operating space for entrepreneurs but also offer more possibilities for innovation and resource support.
- (3) Knowledge acquisition and knowledge sharing capability partially mediate the relationship between digital entrepreneurial ecosystem embeddedness and user entrepreneurial opportunity development. Digital entrepreneurial ecosystem embeddedness enhances the knowledge dynamics capability of entrepreneurial users, enabling them to adjust opportunities at lower costs and engage in opportunity co-creation through more convenient social network interactions, thereby driving entrepreneurial opportunity development [7,8,26]. However, we also recognize that the digital divide may negatively impact this process. Some communities or groups may face challenges due to insufficient digital skills and literacy, hindering their full utilization of resources

and opportunities within the digital entrepreneurial ecosystem, leading to exclusionary phenomena [57,59,60]. In light of this, our research goes beyond enhancing the efficiency of digital entrepreneurial ecosystems to emphasize ensuring fairness and inclusivity within this ecosystem [3,57]. Our study provides valuable insights for designing and nurturing digital entrepreneurial ecosystems to support fair opportunity development and reduce social exclusion. Specifically, to achieve fair opportunity development and reduce social exclusion, the design of digital entrepreneurial ecosystems needs to consider differences in digital technology and literacy among different groups [60,66]. Policymakers and practitioners can draw on our research findings to implement corresponding measures to mitigate the impact of the digital divide and promote the development of more inclusive digital entrepreneurial ecosystems. This may include implementing policy interventions targeting the digital divide, promoting digital technology popularization and digital literacy enhancement through educational programs, and engaging in community participation projects to enhance the inclusivity of digital entrepreneurial ecosystems [67,68].

- (4) In the dual-path model of digital entrepreneurial ecosystem embeddedness on user entrepreneurial opportunity development, knowledge sharing capability emerges as the superior path. Digital entrepreneurial ecosystem embeddedness facilitates knowledge sharing capability by constructing collaborative platforms and promoting the sharing of knowledge resources, supporting the dissemination and utilization of other innovative assets such as technology, processes, and intellectual property among members of the platform ecosystem [3,7]. This further reduces the knowledge gap in discovering and exploiting potential opportunities, assisting entrepreneurial users in innovatively searching, acquiring, and integrating resources, accelerating the identification, assessment, and validation of entrepreneurial opportunities [26]. Recent research indicates that global challenges, such as the COVID-19 pandemic, have profoundly impacted digital entrepreneurial ecosystems. Yáñez-Valdés and Guerrero found that the pandemic accelerated digital transformation and altered innovation patterns [18]. This change intensified the dynamism of digital entrepreneurial ecosystems, particularly in embedding and knowledge sharing within the ecosystem [69]. In this new environment, the role of collaborative platforms becomes particularly crucial. During the pandemic, many businesses utilized collaborative platforms to facilitate the sharing and utilization of knowledge resources in response to new challenges and opportunities [70,71]. This enhanced knowledge sharing helped user entrepreneurial enterprises better adapt to changes, expediting the process of identifying, assessing, and validating entrepreneurial opportunities [26]. Therefore, in the dual-path model of digital entrepreneurial ecosystem embeddedness, knowledge sharing capability emerges as the superior path.
- (5) The digital entrepreneurial ecosystem plays a crucial role in advancing sustainability. Research indicates that it provides new opportunities and solutions for environmental sustainability, social inclusivity, and economic development through fostering innovation, knowledge sharing, and resource utilization [72–74]. Firstly, the embedding of digital entrepreneurial ecosystems accelerates the dissemination and sharing of knowledge, thereby promoting the development and spread of innovation [26]. This shared knowledge not only assists businesses in adapting to change but also offers technical and managerial support for achieving sustainability goals [56,61]. Secondly, the digital entrepreneurial ecosystem provides a platform for promoting collaboration and resource sharing. Through collaborative platforms, businesses share knowledge, technology, and resources to collectively address environmental changes and market challenges. This collaboration and resource sharing expedite the innovation process, driving the development of new products and services and thereby promoting sustainable economic growth [5]. However, the development of digital entrepreneurial ecosystems also faces challenges, including the existence of the digital divide [58]. The digital divide may limit some communities or groups from fully participating

in digital entrepreneurial ecosystems, thereby hindering the achievement of sustainability goals. Therefore, addressing the digital divide is crucial [60]. Governments, businesses, and social organizations can take measures, including providing digital technology training, improving digital infrastructure, and promoting digital innovation, to narrow the digital divide and ensure that more people can benefit from digital entrepreneurial ecosystems [60,75]. In conclusion, digital entrepreneurial ecosystems play an essential role in achieving sustainability goals. By fostering innovation, knowledge sharing, and resource utilization, they provide new opportunities and solutions for environmental sustainability, social inclusivity, and economic development. However, achieving sustainability goals requires collective efforts, including addressing issues such as the digital divide, to ensure the fairness and inclusivity of digital entrepreneurial ecosystems for full advancement of sustainability.

6. Conclusions

6.1. Theoretical Contributions

First, this study reveals both promoting and challenging effects on existing theoretical frameworks in the fields of entrepreneurship and knowledge management. By uncovering the impact mechanism of digital entrepreneurship ecosystem embedding on user entrepreneurial opportunity development, this research provides a deeper understanding for the field of entrepreneurship. It underscores the significance of digital entrepreneurial ecosystems in the digital era and emphasizes the influence of external environmental factors on entrepreneurial opportunity development. These insights are crucial for advancing entrepreneurship theory as they offer a more concrete and systematic framework to explain how digital entrepreneurial ecosystems affect the identification and development of entrepreneurial opportunities. However, these findings also challenge existing theories in entrepreneurship and knowledge management. Traditional entrepreneurship theories may not fully consider the influence of digital entrepreneurial ecosystems on entrepreneurial opportunity development in the digital environment. Therefore, the results of this study propose a new perspective that needs to be integrated with traditional theories to better explain entrepreneurial activities in the digital entrepreneurship environment. From a knowledge management perspective, this study underscores the importance of digital entrepreneurship ecosystem embedding in knowledge acquisition and sharing capabilities. This poses a new challenge to knowledge management theory as it emphasizes the critical role of dynamic knowledge capabilities in digital environments for entrepreneurial success. Traditional knowledge management theories may focus more on internal knowledge flow and management within traditional enterprises, paying less attention to external knowledge acquisition and sharing in the digital entrepreneurship environment. Thus, our results challenge the limitations of existing knowledge management frameworks and call for strengthened research on knowledge acquisition and sharing in digital entrepreneurial ecosystems to better address the challenges of the digital era and promote the sustainability of digital entrepreneurial ecosystems.

Second, this study sheds light on the mediating mechanisms of different types of knowledge dynamic capabilities from the perspective of knowledge dynamic capability theory. By merging the knowledge-based view with dynamic capability theory, it systematically examines how ecosystem embeddedness influences knowledge dynamics. It uncovers the mediating mechanisms and optimal pathways of knowledge acquisition and sharing capabilities between ecosystem embeddedness and user entrepreneurial opportunity development, providing novel theoretical insights into digital entrepreneurship. Moreover, alternative perspectives like complexity theory or network theory can enrich the interpretation of findings. Complexity theory focuses on the interactions and nonlinear effects among internal elements of systems, which is applicable for explaining the complex relationships among various factors in the digital entrepreneurship ecosystem. For instance, it can help understand how various factors interact and generate nonlinear effects, thereby influencing entrepreneurial opportunity development. On the other hand, network

theory emphasizes the connections and structures within systems, which is suitable for revealing the connections and influences among different stakeholders in the digital entrepreneurship ecosystem. Contrasting these theoretical frameworks with current theories of entrepreneurial ecosystems and dynamic capabilities provides a more comprehensive understanding of the mechanisms at play in the digital entrepreneurship ecosystem. For example, compared to traditional theories of entrepreneurial ecosystems, complexity theory and network theory may focus more on the dynamic changes and complex relationships within systems, offering new perspectives on entrepreneurial opportunity identification and development in the digital entrepreneurship ecosystem.

Third, this study uncovers how entrepreneurial learning moderates the relationship between digital entrepreneurial ecosystem embeddedness and knowledge dynamic capabilities. By delving into the moderating effect of entrepreneurial learning, the study unveils the multi-level, multidimensional relationship between the embedding of digital entrepreneurship ecosystems and knowledge dynamic capability. The positive moderating effect highlights how entrepreneurial learning facilitates the impact of embedding digital entrepreneurship ecosystems on entrepreneurs' learning processes, offering deeper theoretical guidance for optimizing digital entrepreneurship ecosystems. One underexplored aspect in the current literature is entrepreneurial learning, particularly its moderating role within digital entrepreneurship ecosystems. Entrepreneurial learning, encompassing knowledge, skills, and experiences gained during entrepreneurship, significantly influences behaviors and decisions within these ecosystems. However, research often overlooks how entrepreneurial learning interacts with elements like knowledge dynamic capability. Understanding how entrepreneurial learning moderates knowledge dynamic capability is crucial for grasping ecosystem functioning. Knowledge dynamic capability involves knowledge acquisition, sharing, and utilization for environmental adaptation, critical in digital entrepreneurship ecosystems. However, the current literature lacks comprehensive exploration of how entrepreneurial learning influences this moderating role. This study addresses this gap by examining entrepreneurial learning's moderating role between ecosystem embeddedness and knowledge dynamic capability, revealing their intricate dynamics.

6.2. Practical Implications

For user entrepreneurs, it is crucial to actively embed themselves into the digital entrepreneurial ecosystem. They should leverage its abundant resources and digital entrepreneurial networks to expand the scope of entrepreneurial resource acquisition, efficiently acquire the knowledge and information needed for user entrepreneur development, and establish close connections with other entrepreneurial ecosystem entities. This involves focusing on multi-party interactions among digital entrepreneurial enterprises, digital users, and universities or research institutions to form resource combinations, thereby enhancing the efficiency and quality of entrepreneurial opportunity development. Additionally, entrepreneurs should enrich their social networks, strengthen their knowledge dynamic capabilities, and engage in entrepreneurial learning. Utilizing digital platforms such as e-commerce platforms, open-source communities, and social media networks to expand cooperation networks and establish user networks can foster a sustainable entrepreneurial learning mechanism. This enables entrepreneurs to overcome their weaknesses, enhance their dynamic entrepreneurial capabilities, and facilitate efficient identification and development of entrepreneurial opportunities.

In addition, for user entrepreneurs to effectively leverage the digital entrepreneurial ecosystem for opportunity development, they need to adhere to social norms, overcome psychological barriers, and harness the power of technological advancements to continuously enhance their entrepreneurial capabilities and competitive advantages. Firstly, they should actively engage in digital entrepreneurial communities, adhere to social norms, and establish a strong business reputation. Secondly, user entrepreneurs need to overcome psychological barriers, including fear of failure and self-doubt. Moreover, they should

stay abreast of technological advancements, adeptly utilizing new technologies and tools to improve entrepreneurial efficiency and innovation capabilities. For instance, they can leverage technologies such as artificial intelligence and big data analytics to gain deeper insights into user needs, optimize product design, and refine marketing strategies.

For the government, efforts should be made to optimize the local digital entrepreneurship ecosystem by providing robust infrastructure and policy environment to attract more entrepreneurs and innovative enterprises. Government departments should further increase funding or policy support, such as tax incentives, rent reductions, entrepreneurship training and guidance, market access, and innovation support, to promote the aggregation of various digital entities such as universities, research institutes, investment institutions, and incubators, enhancing the operational efficiency of the digital entrepreneurship ecosystem. Additionally, the government should invest in infrastructure development, including supporting the development of universities, research institutes, investment institutions, and incubators, as well as investing in the construction of co-working spaces, digital entrepreneurship hubs, incubators, and innovation and entrepreneurship training camps, to provide necessary support and resources for entrepreneurs, effectively promoting digital entrepreneurship ecosystem embeddedness. Furthermore, the government should enrich public training entrepreneurship courses, establish sound knowledge resource sharing and governance mechanisms to foster an open and collaborative, continuous learning regional digital entrepreneurship ecosystem, providing a favorable entrepreneurial service and environment for user entrepreneurs and others. Moreover, the government should strengthen regulation and management of the digital entrepreneurship ecosystem, protect innovation achievements and intellectual property rights, and boost entrepreneurs' confidence and innovation drive, thereby promoting the sustainability of the digital entrepreneurship ecosystem.

In addition to the above, governments can employ various strategies to alleviate the impact of the digital divide and foster a more inclusive digital entrepreneurship ecosystem, promoting its sustainability. First, governments can review and develop policy interventions to ensure that digital technologies are universally available and accessible, including the provision of infrastructure and network coverage in remote areas. Second, governments can adopt technological solutions, such as providing easy access to digital services and apps, to meet the needs of different groups, especially underrepresented groups. Educational programs are also important, and governments can provide digital literacy training and technology education to improve people's digital literacy and skill levels. Finally, governments can encourage community collaboration and resource sharing through community-based initiatives, such as supporting local digital entrepreneurship and innovation projects, to promote equitable opportunity development and reduce social exclusion. Implementation of these strategies will help establish a more inclusive digital entrepreneurship ecosystem, fostering its sustainability and societal prosperity.

6.3. Limitations and Future Research

This study has some limitations that may inspire future research. Firstly, the scope and applicability of the research could be further expanded. Due to constraints such as time and resources, the current study's sample selection was relatively narrow, limited to Chinese enterprises, leading to geographical and cultural biases. Future research could broaden the sample to include a more diverse range of entrepreneurial ventures, including those led by underrepresented groups or operating in different sectors, while increasing diversity in regions and industries to enrich survey results and enhance the generalizability of findings. Additionally, longitudinal effects, the impact of technological advancements, and comparative studies of different entrepreneurial ecosystems or cultural backgrounds could be explored, aiding in a deeper understanding of the mechanisms through which digital entrepreneurial ecosystems affect opportunity development.

Secondly, the moderating effects of entrepreneurial learning need further exploration. Subsequent research could delve into how entrepreneurial learning moderates the rela-

relationship between knowledge acquisition, sharing capabilities, and entrepreneurial opportunities. Lastly, there is room for further exploration of intermediary mechanisms. This study only revealed the mediating role of knowledge dynamic capabilities between digital entrepreneurial ecosystem embeddedness and user entrepreneurial opportunity development. However, other potential intermediary factors, such as co-working space networks and digital literacy, have not been thoroughly analyzed. Future research could expand on intermediary factors to comprehensively reveal the mechanisms through which digital entrepreneurial ecosystems impact user entrepreneurial opportunity development. This includes systematically studying multi-faceted intermediary mechanisms involving individual entrepreneurial characteristics, organizational factors, and external environments to deepen the understanding of the mechanisms underlying digital entrepreneurial ecosystem embeddedness.

Author Contributions: Conceptualization and writing—review and editing, J.Z. and W.C.; methodology, J.Z.; software, W.C.; validation, W.C.; formal analysis, W.C.; investigation, J.Z. and W.C.; resources, J.Z. and W.C.; data curation, W.C.; writing—original draft preparation, W.C.; visualization, W.C.; supervision, J.Z.; project administration, J.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Social Science Fund of China (Grant number: 20BGL055).

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the School of Economics and Management of Guangxi Normal University (protocol code 4503112013588 and approval date 20 September 2023).

Informed Consent Statement: Informed consent was obtained from the participants involved in this research.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: The authors would like to thank the reviewers for their helpful comments and constructive suggestions, which have been very useful for improving the presentation of this paper. In addition, the authors use the ChatGPT tool to polish the language of certain paragraphs in the article, such as the Introduction and Hypothesis Sections, to help readers better read and understand the content.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Zhou, J.; Song, Z. Research on the influencing factors of user entrepreneurial intention under the background of innovation-driven—Based on qualitative analysis paradigm of grounded theory. *J. South China Univ. Technol. (Soc. Sci. Ed.)* **2020**, *22*, 28–36.
2. Nambisan, S. Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrep. Theory Pract.* **2017**, *41*, 1029–1055. [[CrossRef](#)]
3. Sussan, F.; Acs, Z.J. The digital entrepreneurial ecosystem. *Small Bus. Econ.* **2017**, *49*, 55–73. [[CrossRef](#)]
4. Suseno, Y.; Laurell, C.; Sick, N. Assessing value creation in digital innovation ecosystems: A Social Media Analytics approach. *J. Strateg. Inf. Syst.* **2018**, *27*, 335–349. [[CrossRef](#)]
5. Xu, L.; Yang, S.; Liu, Y.; Newbert, S.L.; Boal, K. Seeing the Forest and the Trees: Exploring the Impact of Inter-and Intra-Entrepreneurial Ecosystem Embeddedness on New Venture Creation. *Acad. Manag. J.* **2023**, *66*, 1954–1982. [[CrossRef](#)]
6. Thompson, T.A.; Purdy, J.M.; Ventresca, M.J. How entrepreneurial ecosystems take form: Evidence from social impact initiatives in Seattle. *Strateg. Entrep. J.* **2018**, *12*, 96–116. [[CrossRef](#)]
7. Nambisan, S.; Wright, M.; Feldman, M. The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Res. Policy* **2019**, *48*, 103773. [[CrossRef](#)]
8. Zhu, X.; Yang, S. Research on multi-agent collaboration mechanism in digital entrepreneurship ecosystem. *Manag. Rev.* **2023**, *20*, 86–95.

9. Zhou, J.; Li, W. Research on the relationship between user resource innovation capability, entrepreneurial mode, and entrepreneurial performance: The moderating effect of dual network embeddedness in makerspaces. *Sci. Technol. Prog. Policy* **2024**, *41*, 33–42.
10. Shah, S.K.; Tripsas, M. The accidental entrepreneur: The emergent and collective process of user entrepreneurship. *Strateg. Entrep. J.* **2007**, *1*, 123–140. [\[CrossRef\]](#)
11. Srivastava, S.; Panda, S.; Williams, W.A. User-entrepreneurship and innovation: Does customer involvement and learning orientation matter? *J. Bus. Ind. Mark.* **2022**, *37*, 1182–1196.
12. Oo, P.P.; Allison, T.H.; Sahaym, A.; Juasrikul, S. User entrepreneurs' multiple identities and crowdfunding performance: Effects through product innovativeness, perceived passion, and need similarity. *J. Bus. Ventur.* **2019**, *34*, 105895. [\[CrossRef\]](#)
13. Zhou, J.; Li, W. The relationship between user entrepreneurial learning, entrepreneurial capability, and entrepreneurial performance: The moderating effect of network embeddedness in crowdsourcing spaces. *Sci. Technol. Manag. Res.* **2023**, *43*, 195–203.
14. Escobar, O.; Schiavone, F.; Khvatova, T.; Maalaoui, A. Lead user innovation and entrepreneurship: Analyzing the current state of research. *J. Small Bus. Manag.* **2023**, *61*, 1174–1191. [\[CrossRef\]](#)
15. Liu, Z.; Li, B.; Zhuang, X. Research on the mechanism of entrepreneurial opportunity iteration in startups. *Stud. Sci. Sci.* **2019**, *37*, 500–516.
16. Chang, J.; Bai, X.; Li, J.J. The influence of leadership on product and process innovations in China: The contingent role of knowledge acquisition capability. *Ind. Mark. Manag.* **2015**, *50*, 18–29. [\[CrossRef\]](#)
17. Presbitero, A.; Roxas, B.; Chadee, D. Effects of intra-and inter-team dynamics on organisational learning: Role of knowledge-sharing capability. *Knowl. Manag. Res. Pract.* **2017**, *15*, 146–154. [\[CrossRef\]](#)
18. Yáñez-Valdés, C.; Guerrero, M. Determinants and impacts of digital entrepreneurship: A pre-and post-COVID-19 perspective. *Technovation* **2024**, *132*, 102983. [\[CrossRef\]](#)
19. Annarelli, A.; Battistella, C.; Nonino, F.; Parida, V.; Pessot, E. Literature review on digitalization capabilities: Co-citation analysis of antecedents, conceptualization and consequences. *Technol. Forecast. Soc. Chang.* **2021**, *166*, 120635. [\[CrossRef\]](#)
20. Cao, Y.; Li, J. Configuration study on effective antecedents of entrepreneurial dynamic capabilities in the digital context. *Sci. Technol. Prog. Countermeas.* **2022**, *39*, 12–21.
21. Du, J.; Wang, T.; Hao, X.; Feng, T. Formation and development of entrepreneurial opportunities in digital ecosystems: An exploration based on social capital theory. *Adv. Psychol. Sci.* **2022**, *30*, 1205–1215. [\[CrossRef\]](#)
22. Mas, J.M.; Gómez, A. Social partners in the digital ecosystem: Will business organizations, trade unions and government organizations survive the digital revolution? *Technol. Forecast. Soc. Chang.* **2021**, *162*, 120349. [\[CrossRef\]](#)
23. Bejjani, M.; Göcke, L.; Menter, M. Digital entrepreneurial ecosystems: A systematic literature review. *Technol. Forecast. Soc. Chang.* **2023**, *189*, 122372. [\[CrossRef\]](#)
24. Sahut, J.M.; Iandoli, L.; Teulon, F. The age of digital entrepreneurship. *Small Bus. Econ.* **2021**, *56*, 1159–1169. [\[CrossRef\]](#)
25. Du, W.; Pan, S.L.; Zhou, N.; Ouyang, T. From a marketplace of electronics to a digital entrepreneurial ecosystem (DEE): The emergence of a meta-organization in Zhongguancun, China. *Inf. Syst. J.* **2018**, *28*, 1158–1175. [\[CrossRef\]](#)
26. Elia, G.; Margherita, A.; Passiante, G. Digital entrepreneurship ecosystem: How digital technologies and collective intelligence are reshaping the entrepreneurial process. *Technol. Forecast. Soc. Chang.* **2020**, *150*, 119791. [\[CrossRef\]](#)
27. Zheng, S.; Zhang, W.; Du, J. Knowledge-based dynamic capabilities and innovation in networked environments. *J. Knowl. Manag.* **2011**, *15*, 1035–1051. [\[CrossRef\]](#)
28. Shamim, S.; Cang, S.; Yu, H. Impact of knowledge oriented leadership on knowledge management behaviour through employee work attitudes. *Int. J. Hum. Resour. Manag.* **2019**, *30*, 2387–2417. [\[CrossRef\]](#)
29. Salvato, C.; Vassolo, R. The sources of dynamism in dynamic capabilities. *Strateg. Manag. J.* **2018**, *39*, 1728–1752. [\[CrossRef\]](#)
30. Gonzalez, R.V.D. Innovative performance of project teams: The role of organizational structure and knowledge-based dynamic capability. *J. Knowl. Manag.* **2022**, *26*, 1164–1186. [\[CrossRef\]](#)
31. Schulz, M. The uncertain relevance of newness: Organizational learning and knowledge flows. *Acad. Manag. J.* **2001**, *44*, 661–681. [\[CrossRef\]](#)
32. Eggers, J.P. All experience is not created equal: Learning, adapting, and focusing in product portfolio management. *Strateg. Manag. J.* **2012**, *33*, 315–335. [\[CrossRef\]](#)
33. Granovetter, M. Economic action and social structure: The problem of embeddedness. In *The Sociology of Economic Life*; Routledge: Abingdon, UK, 2018; pp. 22–45.
34. Ritter, T.; Pedersen, C.L. Digitization capability and the digitalization of business models in business-to-business firms: Past, present, and future. *Ind. Mark. Manag.* **2020**, *86*, 180–190. [\[CrossRef\]](#)
35. Kaur, V. *Knowledge-Based Dynamic Capabilities: The Road Ahead in Gaining Organizational Competitiveness*; Springer International Publishing: Cham, Switzerland, 2019; pp. 12–35.
36. Khaksar, S.M.S.; Chu, M.T.; Rozario, S.; Slade, B.W. Knowledge-based dynamic capabilities and knowledge worker productivity in professional service firms: The moderating role of organizational culture. *Knowl. Manag. Res. Pract.* **2023**, *21*, 241–258. [\[CrossRef\]](#)
37. Del Bosco, B.; Chierici, R.; Mazzucchelli, A. User entrepreneurship in the video game industry: The role of communities. *J. Small Bus. Enterp. Dev.* **2020**, *27*, 681–701. [\[CrossRef\]](#)

38. Riviuccio, G.; Raïes, K.; Schiavone, F. Are you attractive enough? An empirical analysis on user innovators' characteristics and the creation of new social ventures. *Technol. Forecast. Soc. Chang.* **2023**, *189*, 122383. [\[CrossRef\]](#)
39. Nambisan, S.; Siegel, D.; Kenney, M. On open innovation, platforms, and entrepreneurship. *Strateg. Entrep. J.* **2018**, *12*, 354–368. [\[CrossRef\]](#)
40. Kraus, S.; Ribeiro-Soriano, D.; Schüssler, M. Fuzzy-set qualitative comparative analysis (fsQCA) in entrepreneurship and innovation research—the rise of a method. *Int. Entrep. Manag. J.* **2018**, *14*, 15–33. [\[CrossRef\]](#)
41. Schiavone, F.; Tutore, I.; Cucari, N. How digital user innovators become entrepreneurs: A sociomaterial analysis. *Technol. Anal. Strateg. Manag.* **2020**, *32*, 683–696. [\[CrossRef\]](#)
42. Zahra, S.A.; Liu, W.; Si, S. How digital technology promotes entrepreneurship in ecosystems. *Technovation* **2023**, *119*, 102457. [\[CrossRef\]](#)
43. Politis, D. The process of entrepreneurial learning: A conceptual framework. *Entrep. Theory Pract.* **2005**, *29*, 399–424. [\[CrossRef\]](#)
44. Cai, L.; Shan, B.; Tang, S.; Gao, X. A review of entrepreneurial learning research and the construction of an integration framework. *Foreign Econ. Manag.* **2012**, *34*, 17.
45. Pugh, R.; Soetanto, D.; Jack, S.L.; Hamilton, E. Developing local entrepreneurial ecosystems through integrated learning initiatives: The Lancaster case. *Small Bus. Econ.* **2021**, *56*, 833–847. [\[CrossRef\]](#)
46. Nambisan, S.; Baron, R.A. On the costs of digital entrepreneurship: Role conflict, stress, and venture performance in digital platform-based ecosystems. *J. Bus. Res.* **2021**, *125*, 520–532. [\[CrossRef\]](#)
47. Cao, Y.; Li, J. Research on the driving mechanism of digital entrepreneurial ecosystem embeddedness on entrepreneurial opportunity iteration. *Soft Sci.* **2024**, *38*, 1–7.
48. Gold, A.H.; Malhotra, A.; Segars, A.H. Knowledge management: An organizational capabilities perspective. *J. Manag. Inf. Syst.* **2001**, *18*, 185–214. [\[CrossRef\]](#)
49. Samuelsson, M. *Creating New Ventures: A Longitudinal Investigation of the Nascent Venturing Process*; Internationella Handelshögskolan: Jönköping, Sweden, 2004.
50. Long, D.; Zhang, Y.; Li, Y. Research on the formation of new enterprises under the interaction of experience and opportunity innovation. *Manag. Sci.* **2013**, *26*, 1–10.
51. Shan, B.; Cai, L.; Lu, X.; Liu, Z. Connotation, dimensions, and measurement of entrepreneurial learning. *Stud. Sci. Sci.* **2014**, *32*, 1867–1875.
52. Baum, M.A.; Lake, D.A. The political economy of growth: Democracy and human capital. *Am. J. Political Sci.* **2003**, *47*, 333–347. [\[CrossRef\]](#)
53. Wang, L.; Shao, J. Digital economy, entrepreneurship and energy efficiency. *Energy* **2023**, *269*, 126801. [\[CrossRef\]](#)
54. Young, C.; Holsteen, K. Model uncertainty and robustness: A computational framework for multimodel analysis. *Sociol. Methods Res.* **2017**, *46*, 3–40. [\[CrossRef\]](#)
55. Beliaeva, T.; Ferasso, M.; Kraus, S.; Damke, E.J. Dynamics of digital entrepreneurship and the innovation ecosystem: A multilevel perspective. *Int. J. Entrep. Behav. Res.* **2020**, *26*, 266–284. [\[CrossRef\]](#)
56. Gregori, P.; Holzmann, P. Digital sustainable entrepreneurship: A business model perspective on embedding digital technologies for social and environmental value creation. *J. Clean. Prod.* **2020**, *272*, 122817. [\[CrossRef\]](#)
57. Liu, Q.; Liu, Y.; Zhang, C.; An, Z.; Zhao, P. Elderly mobility during the COVID-19 pandemic: A qualitative exploration in Kunming, China. *J. Transp. Geogr.* **2021**, *96*, 103176. [\[CrossRef\]](#)
58. Riggins, F.J.; Dewan, S. The digital divide: Current and future research directions. *J. Assoc. Inf. Syst.* **2005**, *6*, 4. [\[CrossRef\]](#)
59. Song, A.K. The Digital Entrepreneurial Ecosystem—A critique and reconfiguration. *Small Bus. Econ.* **2019**, *53*, 569–590. [\[CrossRef\]](#)
60. Vassilakopoulou, P.; Hustad, E. Bridging digital divides: A literature review and research agenda for information systems research. *Inf. Syst. Front.* **2023**, *25*, 955–969. [\[CrossRef\]](#) [\[PubMed\]](#)
61. Dy, A.M. Levelling the playing field? Towards a critical-social perspective on digital entrepreneurship. *Futures* **2022**, *135*, 102438.
62. Smith, C.; Smith, J.B.; Shaw, E. Embracing digital networks: Entrepreneurs' social capital online. *J. Bus. Ventur.* **2017**, *32*, 18–34. [\[CrossRef\]](#)
63. Huđek, I.; Tominc, P.; Širec, K. The impact of social and cultural norms, government programs and digitalization as entrepreneurial environment factors on job and career satisfaction of freelancers. *Sustainability* **2021**, *13*, 779. [\[CrossRef\]](#)
64. Sobaih, A.E.E.; Elshaer, I.A. Personal traits and digital entrepreneurship: A mediation model using SmartPLS data analysis. *Mathematics* **2022**, *10*, 3926. [\[CrossRef\]](#)
65. Yao, M.; Li, J. The causal exploration of digital entrepreneurial psychological capital configurations based on fsQCA. *J. Innov. Knowl.* **2023**, *8*, 100291. [\[CrossRef\]](#)
66. Kraus, S.; Palmer, C.; Kailer, N.; Kallinger, F.L.; Spitzer, J. Digital entrepreneurship: A research agenda on new business models for the twenty-first century. *Int. J. Entrep. Behav. Res.* **2019**, *25*, 353–375. [\[CrossRef\]](#)
67. Zhao, X.; Weng, Z. Digital dividend or divide: The digital economy and urban entrepreneurial activity. *Socio-Econ. Plan. Sci.* **2024**, *93*, 101857. [\[CrossRef\]](#)
68. Neumeyer, X.; Santos, S.C.; Morris, M.H. Overcoming barriers to technology adoption when fostering entrepreneurship among the poor: The role of technology and digital literacy. *IEEE Trans. Eng. Manag.* **2020**, *68*, 1605–1618. [\[CrossRef\]](#)
69. Khurana, I.; Dutta, D.K.; Ghura, A.S. SMEs and digital transformation during a crisis: The emergence of resilience as a second-order dynamic capability in an entrepreneurial ecosystem. *J. Bus. Res.* **2022**, *150*, 623–641. [\[CrossRef\]](#)

70. He, W.; Zhang, Z.J.; Li, W. Information technology solutions, challenges, and suggestions for tackling the COVID-19 pandemic. *Int. J. Inf. Manag.* **2021**, *57*, 102287. [[CrossRef](#)] [[PubMed](#)]
71. Al-Omoush, K.S.; Ribeiro-Navarrete, S.; Lassala, C.; Skare, M. Networking and knowledge creation: Social capital and collaborative innovation in responding to the COVID-19 crisis. *J. Innov. Knowl.* **2022**, *7*, 100181. [[CrossRef](#)]
72. Holzmann, P.; Gregori, P. The promise of digital technologies for sustainable entrepreneurship: A systematic literature review and research agenda. *Int. J. Inf. Manag.* **2023**, *68*, 102593. [[CrossRef](#)]
73. Romanelli, M. Towards sustainable ecosystems. *Syst. Res. Behav. Sci.* **2018**, *35*, 417–426. [[CrossRef](#)]
74. Yáñez-Valdés, C.; Guerrero, M.; Barros-Celume, S.; Ibáñez, M.J. Winds of change due to global lockdowns: Refreshing digital social entrepreneurship research paradigm. *Technol. Forecast. Soc. Chang.* **2023**, *190*, 122454. [[CrossRef](#)]
75. Feurich, M.; Kourilova, J.; Pelucha, M.; Kasabov, E. Bridging the urban-rural digital divide: Taxonomy of the best practice and critical reflection of the EU countries' approach. *Eur. Plan. Stud.* **2024**, *32*, 483–505. [[CrossRef](#)]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.