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# Entrepreneurial Bricolage, Business Model Innovation, and Sustainable Entrepreneurial Performance of Digital Entrepreneurial Ventures: The Moderating Effect of Digital Entrepreneurial Ecosystem Empowerment

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**Abstract:** Digital entrepreneurial ventures are increasingly embracing a high-quality development trajectory that prioritizes green, low-carbon, and sustainable practices, necessitating ongoing environmental enhancements and the active assumption of social responsibilities alongside economic progress. Despite this, there is a significant disparity in the sustainable entrepreneurial performance among these ventures, highlighting the need for an in-depth exploration of the underlying factors. This study develops a theoretical framework that links entrepreneurial bricolage to business model innovation and ultimately to sustainable entrepreneurial performance, all within the context of a digital entrepreneurial ecosystem (DEE). The research focuses on 371 digital ventures operating within the DEE, examining the relationships and effects among the variables. The findings indicate that entrepreneurial bricolage has a positive impact on sustainable entrepreneurial performance. Furthermore, entrepreneurial bricolage is found to foster business model innovation, which in turn, enhances sustainable performance. The investigation demonstrates that business model innovation partially mediates in the link between entrepreneurial bricolage and the sustainable entrepreneurial performance. Additionally, the DEE's empowering influence is shown to positively regulate the connection between entrepreneurial bricolage and business model innovation, as well as between business model innovation and sustainable entrepreneurial performance. The empowering effect of the DEE also exerts a positive moderating influence on the indirect impact of sustainable entrepreneurial performance mediated by business model innovation, stemming from entrepreneurial bricolage. This study underscores the significance of entrepreneurial bricolage and the digital entrepreneurship ecosystem, demonstrating that digital startups ought to augment their bricolage skills and leverage the ecosystem's support to attain enduring sustainable entrepreneurial performance. The conclusions drawn from this research offer valuable insights and serve as a reference for strategies aimed at enhancing the sustainable performance of digital entrepreneurial ventures within the DEE.

**Keywords:** entrepreneurial bricolage; business model innovation; sustainable entrepreneurial performance; digital entrepreneurial ecosystem; empowerment



**Citation:** Liu, X.; Zhang, L. Entrepreneurial Bricolage, Business Model Innovation, and Sustainable Entrepreneurial Performance of Digital Entrepreneurial Ventures: The Moderating Effect of Digital Entrepreneurial Ecosystem Empowerment. *Sustainability* **2024**, *16*, 8168. https://doi.org/10.3390/su16188168

Academic Editor: Alina Badulescu

Received: 13 August 2024
Revised: 16 September 2024
Accepted: 17 September 2024
Published: 19 September 2024



## 1. Introduction

The swift progression of digital technologies has propelled a global surge in the digital economy, a trend underscored by the sector's resilience and responsible conduct during the COVID-19 pandemic [1]. China, in particular, has prioritized the digital economy's growth, initiating the strategic "Digital China" initiative. In this dynamic landscape of digital innovation and economic transformation, digital entrepreneurship has emerged as a

vibrant and burgeoning field [2]. It has captured the imagination of entrepreneurs and has become a catalyst for economic revitalization [3]. Simultaneously, the pressing issues of global warming and environmental degradation have thrust environmental sustainability into the spotlight as a global concern [4]. In response to the current challenges, digital entrepreneurial ventures are shifting their focus. They are now emphasizing a high-quality development path that incorporates green, low-carbon, and sustainable practices. This shift necessitates ongoing environmental stewardship and the integration of social responsibilities within economic endeavors [5]. An increasing number of these ventures recognize that proactive innovation in production and management, coupled with a commitment to green transformation and an ecological economy, is essential for bolstering competitiveness and achieving sustainable growth [6,7]. This trend has garnered significant interest within the academic sphere, prompting extensive research into the environmental and social dividends of digital entrepreneurship [7,8]. The concept of sustainable entrepreneurship adheres to the triple bottom line of sustainable development, encompassing economic, environmental, and social benefits within entrepreneurial activities [9,10]. Despite the emergence of digital entrepreneurial unicorns, there is a contrasting trend of venture closures. New ventures struggle due to limited resources, outdated business models, and inexperience within their teams [11,12]. The disparity in sustainable entrepreneurial performance among digital ventures is significant, necessitating an urgent and thorough examination of the factors influencing this performance.

Securing resources is a critical challenge for new ventures, as it is the cornerstone of their development [13]. In the digital era, where opportunities are ephemeral, resource-constrained digital entrepreneurial ventures confront the urgent challenge of rapidly acquiring the necessary resources to actualize their entrepreneurial ambitions. In this setting, entrepreneurial bricolage is the strategy where startups creatively repurpose existing resources to seize opportunities and tackle challenges, which is pivotal for overcoming hurdles [14–16]. In the digital economy, the evolving digital landscape and its unique characteristics present new demands for ventures. Reconstructing their business models is a vital pathway for ventures to ensure survival and growth [17]. Entrepreneurial bricolage enables digital ventures to swiftly capitalize on new opportunities in the digital marketplace, to innovate by creating distinctive digital products and services, thereby driving business model innovation [18,19]. Business model innovation implies that startups introduce new value propositions, update and recreate existing business models, explore new ways of value capture, and subsequently reconstruct the enterprise's value creation system [20]. This, in turn, aids ventures in uncovering customer needs, integrating resources, enhancing value, overcoming developmental challenges, and ultimately improving performance [21]. Although several academics have acknowledged the connections among entrepreneurial bricolage, business model innovation, and venture performance [22,23], current literature lacks a comprehensive analysis of how entrepreneurial bricolage influences sustainable performance in digital startups, especially considering the role of business model innovation. This paper aims to address this gap and contribute to the understanding of how digital ventures can leverage entrepreneurial bricolage and business model innovation to achieve sustainable success.

In China, a proliferation of entrepreneurial support platforms including industrial clusters, high-tech parks, incubators, maker spaces, and distinctive towns is reshaping the landscape. These platforms, in essence, constitute the fabric of entrepreneurial ecosystems [2]. An entrepreneurial ecosystem is a dynamic and intricate network of diverse stakeholders, with a focus on nurturing entrepreneurial ventures. It offers comprehensive support across various dimensions—talent, capital, market, culture, and policy—to foster the growth and success of these ventures [24]. The digital entrepreneurial ecosystem (DEE) stands out as a particularly dynamic component within the digital economy, characterized by its capacity for industrial concentration and its catalytic impact on innovation [25,26]. Notable examples of DEEs include Zhongguancun in Beijing and Yunqi Town in Hangzhou, which have demonstrated their ability to empower digital ventures, incubate numerous

startups, and significantly unleash the latent potential of the digital market [2]. Although the academic sphere is increasingly acknowledging the importance of DEEs, comprehensive research in this area remains limited, with particularly sparse investigation into how DEEs specifically impact the growth of digital startups.

In light of this research gap, the present study focuses on digital entrepreneurial ventures within the DEE. It constructs a theoretical framework that examines the relationship between entrepreneurial bricolage, business model innovation, and sustainable entrepreneurial performance under the influence of the DEE. The aim is to delve into the mechanisms by which entrepreneurial bricolage and business model innovation contribute to the sustainable performance of ventures within the empowered context of the DEE, thereby enriching the understanding of this critical and evolving field.

The research questions primarily include: (1) How does entrepreneurial bricolage in digital startups affect business model innovation and sustainable entrepreneurial performance? (2) Does business model innovation play a mediating role between entrepreneurial bricolage and sustainable entrepreneurial performance? (3) What moderating effects does digital entrepreneurship ecosystem empowerment have on the relationships between entrepreneurial bricolage and business model innovation, as well as between business model innovation and sustainable entrepreneurial performance? (4) What moderating role does digital entrepreneurship ecosystem empowerment play in the indirect relationship between entrepreneurial bricolage and sustainable entrepreneurial performance through the mediating effect of business model innovation? The subsequent sections of this manuscript are structured as follows: Section 2 delves into a literature review to establish the research hypotheses; Section 3 elaborates on the methodology employed in this study; Section 4 details the data analysis and findings; and Section 5 summarizes the conclusions drawn and offers future research directions.

## 2. Literature Review and Hypotheses

### *2.1. Entrepreneurial Bricolage and Sustainable Entrepreneurial Performance*

In the realm of new ventures, resource acquisition often presents a formidable challenge. However, through the innovative approach of "make-do" and resource reconstruction, entrepreneurial bricolage offers a pathway to transcend these limitations and harness entrepreneurial opportunities [15,16]. This concept prioritizes not the inherent correctness or feasibility of resources, but rather their adaptability and utility. By leveraging the resources at their disposal in a judicious manner, new ventures can extract value at minimal cost, thereby bolstering the economic sustainability of digital entrepreneurial ventures [27]. Referencing the study by Duan et al. [16] and integrating the characteristics of digital entrepreneurship, this research categorizes entrepreneurial bricolage into three dimensions: resource bricolage, user bricolage, and institutional bricolage. Sustainable entrepreneurial performance is divided into three dimensions: economically sustainable performance, environmentally sustainable performance, and socially sustainable performance [4]. Entrepreneurial bricolage transcends mere resource accumulation, embodying a creative application of assets. It is inherently linked to the concept of satisficing, a decision-making strategy that seeks an adequate solution within the constraints of available resources, always aligning with the economic sustainability of digital ventures [19]. Through bricolage, ventures can rectify inefficient resource allocation, rationalize the use of existing assets, and carve out innovative development models. This process not only establishes competitive edges but also enhances the economic sustainability of these ventures [16,18]. Furthermore, bricolage activities can maximize the potential of raw materials, labor, and skills, increasing the configurability and adaptability of resources through reorganization [28,29]. By ingeniously recombining overlooked, obsolete, or single-use resources, digital entrepreneurs can transcend the constraints of the status quo, leading to the creation of unique products [20,30]. This innovation contributes to the environmental sustainability of digital ventures. Additionally, entrepreneurial bricolage empowers digital ventures to offer non-standard products or services that are not readily available in the mainstream

market [31,32], including catering to the needs of the base of the pyramid [33]. This approach not only enriches the social sustainability of digital ventures but also propels their overall sustainable development. Drawing from this comprehensive analysis, the study posits the following hypothesis for digital entrepreneurial ventures within the DEE:

**H1:** *Entrepreneurial bricolage positively influences sustainable entrepreneurial performance.*

### *2.2. Entrepreneurial Bricolage and Business Model Innovation*

Resource scarcity is a common predicament for new ventures, and the reconfiguration of existing resources emerges as a viable strategy for achieving business model innovation [18]. Business model innovation can be achieved by seizing new opportunities. Additionally, it can be realized through the introduction of innovative governance, structural, and transactional strategies [34,35]. Business model innovation is divided into two dimensions: efficiency-oriented business model innovation and novelty-oriented business model innovation [17]. Entrepreneurial bricolage, which involves the integration and reuse of resources to address emerging challenges, facilitates the development of fresh transactional content, structure, and governance mechanisms, thereby capturing new opportunities [14,36]. This bricolage approach enables new ventures to refine the application of their current resources, thus enabling business model innovation [20]. Often, entrepreneurial bricolage yields serendipitous innovation, with some scholars even viewing the act of bricolage as an innovation in itself [19]. It represents an ongoing process of trial and error, aimed at finding the most effective combinations of existing resources to tackle new venture challenges. Throughout this journey, innovations in venture processes and methods of resource integration are bound to occur, culminating in business model innovation [19,20]. In the digital era, entrepreneurial bricolage plays a crucial role for digital entrepreneurial ventures operating within the DEE. It empowers these ventures to swiftly identify and capitalize on new opportunities in the digital marketplace, and thereby to drive business model innovation [19,23]. Given these insights, the study advances the following hypothesis concerning digital entrepreneurial ventures within the DEE:

**H2:** *Entrepreneurial bricolage positively influences business model innovation.*

### *2.3. Business Model Innovation and Sustainable Entrepreneurial Performance*

Essential for securing lasting competitive benefits [22,37], business model innovation is highlighted by Bock et al. [38] as imperative for companies seeking enhanced long-term outcomes through model reinvention. In addition, the potential of technology can usually only be exploited through business model innovation [35,39], which in turn may affect the development of new venture capabilities [40]. Ventures need to focus on business model innovation to gain competitive advantages and improve performance [41,42]. Business model innovation allows ventures to focus on the efficient use and transformation of their internal resources [21]. This approach also fosters information sharing and breaks down information barriers between ventures, which in turn enhances information transparency and reduces transaction uncertainty. By doing so, it lowers transaction costs and bolsters competitive advantages, which are crucial for improving the economically sustainable performance of digital new ventures [43,44]. Moreover, business model innovation empowers startups to prioritize external resource identification and utilization, embrace novel collaboration and transaction frameworks, and expand partnerships and interaction methods to satisfy customer needs innovatively [44]. It also helps in reducing environmental impact by cutting pollution and energy use, thereby boosting the ecological sustainability of digital ventures [45]. Additionally, such innovation leverages both internal and external resources to enhance venture performance, quicken market responsiveness, and elevate customer satisfaction, which in turn fosters the social sustainability of digital ventures and supports their long-term growth [46,47]. Based on the above analysis, for digital entrepreneurial ventures in the DEE, this study proposes the following hypothesis:

**H3:** *Business model innovation has a positive impact on sustainable entrepreneurial performance.*

### *2.4. The Mediating Effect of Business Model Innovation*

In the context of the digital age, business model innovation is an important factor in enhancing the sustainable entrepreneurial performance of digital entrepreneurial ventures [21,45,48]. At the same time, entrepreneurial bricolage in digital entrepreneurial ventures is an important antecedent variable for business model innovation [19,20,23]. Entrepreneurial bricolage promotes the optimal use of resources at hand by new ventures, which is conducive to promoting business model innovation [20,36]. Entrepreneurial bricolage enhances the flexibility and configurability of resources through resource reorganization [28], which helps to save costs for digital entrepreneurial ventures, create unique products and services, and thus promote business model innovation [35]; Entrepreneurial bricolage can help digital entrepreneurial ventures use new business models to improve the efficiency of user services and enhance the ability to meet user needs, promoting business model innovation [49]; entrepreneurial bricolage can encourage new ventures to break the rules and bring new transaction patterns, thereby promoting business model innovation [20]. It can be inferred that entrepreneurial bricolage can promote business model innovation, and business model innovation is an important antecedent for enhancing the sustainable entrepreneurial performance of digital entrepreneurial ventures [19,45]. Therefore, it can be inferred that for digital entrepreneurial ventures in the DEE, entrepreneurial bricolage's influence on sustainable entrepreneurial performance is mediated by business model innovation. Based on the above analysis, for digital entrepreneurial ventures in the DEE, this study proposes the following hypothesis:

**H4:** *Business model innovation has a mediating effect between entrepreneurial bricolage and sustainable entrepreneurial performance.*

### *2.5. The Moderating Effect of Digital Entrepreneurial Ecosystem Empowerment*

The DEE is conducive to carrying out collective collaboration, thereby overcoming the resource limitations of individual ventures and accelerating the creation of digital entrepreneurial ventures, which is conducive to the emergence of business model innovation [2,50]. The DEE can promote the integration of resources and support elements beyond the venture level [51], which is conducive to entrepreneurial bricolage. The interaction between entrepreneurial bricolage and the empowerment of the DEE can have a promoting effect on the business model innovation of new ventures [52]. The DEE, by supporting business model innovation, may have a transformative impact on the organization of economic activities [25]. The digital entrepreneurial ecosystem can empower digital entrepreneurial enterprises through three methods: digital empowerment, resource empowerment, and service empowerment [53]. Autio et al. [52] suggest that the entrepreneurial ecosystem should be regarded as a facet of the digital economy, harnessing technological capabilities to facilitate startups in seeking entrepreneurial opportunities via business model innovation. Additionally, given that digital platforms are capable of accommodating diverse value propositions across extensive markets, startups within the digital economy environment generally do not engage in direct competition with one another. Instead, new ventures that use digital platforms for business model innovation are willing to share their experiences, which also promotes business model innovation [26,52]. It can be seen that the empowerment of the DEE is conducive to promoting business model innovation, and the co-evolution of the empowerment of the DEE and business model innovation may enhance the sustainable entrepreneurial performance of digital entrepreneurial ventures. Based on the above analysis, for digital entrepreneurial ventures in the DEE, this research advances the following hypotheses:

**H5:** *The empowerment of the DEE is expected to enhance the connection between entrepreneurial bricolage and business model innovation.*

**H6:** *The empowerment of the DEE is hypothesized to exert a positive influence on the link between business model innovation and sustainable entrepreneurial performance.*

### *2.6. Moderated Mediation Effect*

A moderated mediation effect is a statistical concept where the influence of a mediator in the relationship between an independent variable and a dependent variable is affected by a moderator. Within the digital era, the resourceful utilization of digital assets by entrepreneurial ventures serves as a crucial precursor to the innovation of business models [20,23]. Entrepreneurial bricolage encourages new ventures to optimize the use of available resources, which is conducive to promoting business model innovation [20], and business model innovation is an important factor in enhancing the sustainable entrepreneurial performance of digital entrepreneurial ventures [42,47]. Therefore, this study proposes a research hypothesis that business model innovation in digital entrepreneurial ventures in the DEE has a mediating effect between entrepreneurial bricolage and sustainable entrepreneurial performance. At the same time, the more empowerment there is in the DEE, the more information flow and cooperation there is among digital entrepreneurial ventures [2], which is conducive to entrepreneurial bricolage and the construction of new business models [52]. The empowerment of the DEE also has a transformative impact on the organization of economic activities by supporting business model innovation [25], thereby enhancing the sustainable entrepreneurial performance of digital entrepreneurial ventures. Consequently, this research posits a hypothesis that the DEE's empowerment exerts a positive influence on the dynamics between entrepreneurial bricolage and business model innovation, as well as between business model innovation and sustainable entrepreneurial performance. Variations in the empowerment level of the DEE are anticipated to alter the impact of entrepreneurial bricolage on business model innovation and, subsequently, the impact of such innovation on sustainable entrepreneurial performance. It is inferred that the pathway by which entrepreneurial bricolage influences sustainable entrepreneurial performance through business model innovation is moderated by the DEE's empowerment. Drawing from this rationale, the study formulates the following hypothesis for digital ventures within the DEE context:

**H7:** *The empowerment of the DEE has a positive moderating effect on the indirect relationship between entrepreneurial bricolage and sustainable entrepreneurial performance through business model innovation.*

Following the preceding analysis, the detailed theoretical framework of this research is depicted in Figure 1.

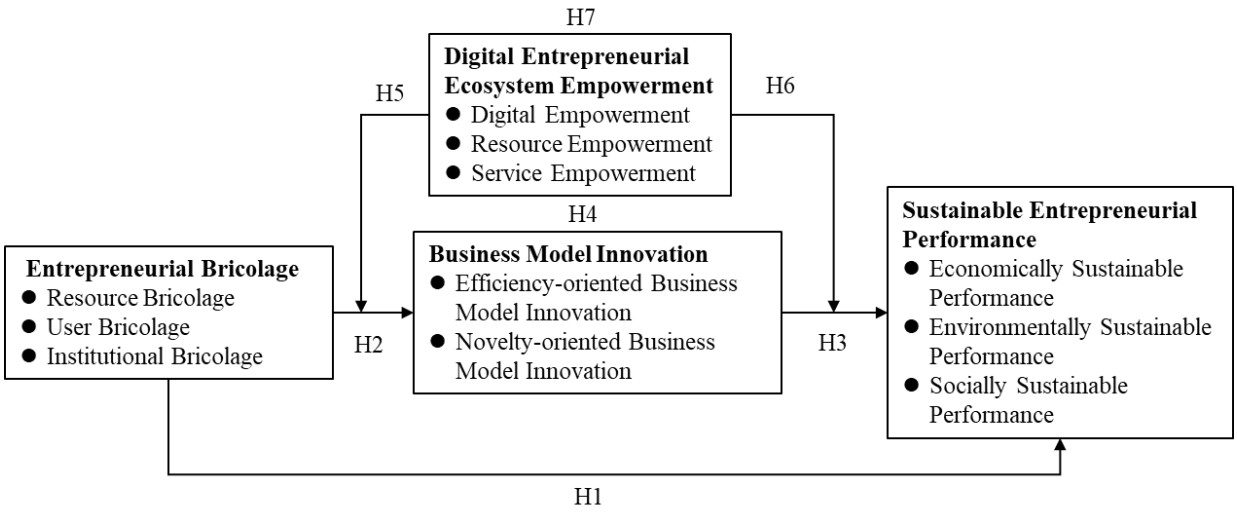


**Figure 1.** Research model.

## 3. Research Design

### *3.1. Variable Selection and Measurement*

In this study, the assessment of variables is conducted using a Likert 5-point scale, where the numbers 1 to 5 represent "strongly disagree", "disagree", "neutral", "agree", and "strongly agree", respectively. As shown in Table 1, entrepreneurial bricolage (EB) is measured using an 11-item scale adapted from Yu et al. [33], which is divided into three dimensions: resource bricolage (RB), user bricolage (UB), and institutional bricolage (IB). Business model innovation (BMI) is measured using a 12-item scale adapted from Zott and Amit [48] and Xiao et al. [44], which is divided into two dimensions: efficiency-oriented business model innovation (EBMI) and novelty-oriented business model innovation (NBMI). Digital entrepreneurial ecosystem empowerment (DEEE) is measured using an 11-item scale adapted from Zhou and Xing [53], which is divided into three dimensions: digital empowerment (DE), resource empowerment (RE), and service empowerment (SE). Sustainable entrepreneurial performance (SEP) is measured using a 10-item scale adapted from Nor-Aishah et al. [4], which is divided into three dimensions: economically sustainable performance (ECSP), environmentally sustainable performance (ENSP), and socially sustainable performance (SOSP). Control variables include the entrepreneur's gender, age, and education level, as well as the company's age and size.

**Table 1.** Variables and items.

| Variable | Variable Dimension | Items |
| --- | --- | --- |
| SEP | ECSP | Our company has increased its market share. |
| | | Our company has improved its profits. |
| | | Our company has reduced cost expenditures. |
| | ENSP | Our company has decreased the frequency of environmental incidents. |
| | | Our company has improved compliance with environmental standards. |
| | | We have enhanced our company's environmental condition. |
| | SOSP | Our company has reduced the impact and risk to the public. |
| | | We have improved occupational health and safety for our employees. |
| | | We have enhanced our company's image in the eyes of customers. |
| | | We have improved our company's social reputation. |

**Table 1.** *Cont.*

| Variable | Variable Dimension | Items |
| --- | --- | --- |
| EB | RB | Our company is adept at using existing labor, raw materials, skills, and other resources to solve problems. |
| | | Our company is skilled at acquiring inexpensive labor, raw materials, skills, and other resources to address issues. |
| | | Our company is proficient in utilizing overlooked labor, raw materials, skills, and other resources to tackle challenges. |
| | UB | Our company frequently encourages digital users to participate in our operations. |
| | | Our company often assists digital users in solving problems that other companies are unwilling or unable to address. |
| | | Our company regularly provides products or services to digital users whom other companies find unattractive. |
| | | Our company often expands into emerging, niche, or marginalized digital markets. |
| | IB | In operations, our company typically employs unique methods rather than traditional approaches used by other companies. |
| | | Our company frequently breaks away from conventional systems and norms during its operations. |
| | | Our company is willing to abandon traditional industry practices if better outcomes can be achieved. |
| | | Our company often utilizes distinctive or proprietary digital systems and norms. |
| BMI | EBMI | We can reduce the cost of products or services. |
| | | We can provide quick and convenient services to users. |
| | | We can lower the search and communication costs for our partners. |
| | | We can reduce the search and communication costs for users. |
| | | We can decrease the asymmetry of information in transactions. |
| | | We can accelerate the speed of transactions. |
| | | We can combine products, information, and services in innovative ways. |
| | NBMI | Our company has created a pricing model that differs from other companies in the industry. |
| | | We have developed new channels that are distinct from those of other companies in the industry. |
| | | We have adopted a profit model that is different from other companies in the industry. |
| | | Our company actively seeks new partners in product production or promotion. |
| | | We can motivate partners in novel ways. |
| DEEE | DE | The digital entrepreneurship ecosystem helps us acquire digital technology. |
| | | The digital entrepreneurship ecosystem helps us identify digital entrepreneurship opportunities using digital technology. |
| | | The digital entrepreneurship ecosystem helps us develop digital entrepreneurship opportunities through the use of digital technology. |
| | RE | The digital entrepreneurship ecosystem provides comprehensive infrastructure. |
| | | The digital entrepreneurship ecosystem offers ample financial support. |
| | | The digital entrepreneurship ecosystem brings us partners. |
| | | The digital entrepreneurship ecosystem brings us users. |
| | | The digital entrepreneurship ecosystem provides us with policy benefits and other information services. |
| | SE | The digital entrepreneurship ecosystem offers intermediary services such as business, tax, and integrated communication. |
| | | The digital entrepreneurship ecosystem frequently provides us with entrepreneurial training and guidance. |
| | | The digital entrepreneurship ecosystem often hosts entrepreneurial salons and sharing sessions. |

Note: SEP denotes sustainable entrepreneurial performance; ECSP denotes economically sustainable performance; ENSP denotes environmentally sustainable performance; SOSP denotes socially sustainable performance; EB denotes entrepreneurial bricolage; RB denotes resource bricolage; UB denotes user bricolage; IB denotes institutional bricolage; BMI denotes business model innovation; EBMI denotes efficiency-oriented business model innovation; NBMI denotes novelty-oriented business model innovation; DEEE denotes digital entrepreneurial ecosystem empowerment; DE denotes digital empowerment; RE denotes resource empowerment; SE denotes service empowerment.

### *3.2. Data Collection and Sample Profile*

To enhance the quality of the sample data as much as possible, this study strictly controlled the subjects, regions, and channels of the questionnaire distribution. Firstly, regarding the research subjects, digital entrepreneurial ventures in the DEE with a founding time of 10 years or less were selected as the research subjects, and entrepreneurs or entrepreneurial team members were chosen as the respondents of the questionnaire. Secondly, for the research area, the Yangtze River Delta region in China was selected as the research area. In specific operations, two DEEs were selected in each of Shanghai, Jiangsu Province, Zhejiang Province, and Anhui Province, totaling 8 DEEs. To enhance the representativeness of the DEE, one ecosystem was selected in both the provincial capital cities (Nanjing, Hangzhou, Hefei) and non-provincial capital cities (Xuzhou, Shaoxing, Suzhou) of Jiangsu, Zhejiang, and Anhui provinces, respectively. The selected DEEs include characteristic towns and science and innovation parks that focus on the application of digital technology and support the growth of digital entrepreneurial ventures, ensuring the diversity of the DEE. Finally, for the research channel, the questionnaire was distributed and collected mainly through the following methods: by leveraging the power of the research team members and their social network connections to contact the operators and managers of the relevant DEEs, and then through their introduction, the research team members directly distributed and collected the questionnaires to eligible digital new ventures in the ecosystems, or requested the operators and managers of the DEEs to distribute and collect the questionnaires on their behalf. The questionnaire also set items to exclude surveys that do not belong to the scope of this study. A total of 472 questionnaires were collected in this study, and 101 questionnaires that did not meet the research scope, were incomplete, or had repetitive single options were excluded, resulting in 371 valid questionnaires. The recovery rate is 78.60%, which is within acceptable limits [36].

## 4. Data Analysis and Hypothesis Testing

### *4.1. Descriptive Analysis*

In terms of gender, there are 237 male entrepreneurs and 134 female entrepreneurs, indicating a higher number of male entrepreneurs compared to female entrepreneurs. Regarding age, there are 48 individuals under 25 years old (12.9%), 123 individuals aged 25–29 (33.2%), 102 individuals aged 30–34 (27.5%), 59 individuals aged 35–39 (15.9%), and 39 individuals aged 40 and above (10.5%). In terms of education, there are 51 individuals with a high school education or below (13.7%), 122 with an associate degree (32.9%), 135 with a bachelor's degree (36.4%), and 63 with a graduate degree (17.0%). For company age, there are 85 companies established within 2 years (22.9%), 108 companies between 2–4 years (29.1%), 89 companies between 4–6 years (24.0%), 50 companies between 6–8 years (13.5%), and 39 companies between 8–10 years (10.5%). In terms of company size, there are 74 companies with fewer than 20 employees (19.9%), 83 companies with 20–49 employees (22.4%), 103 companies with 50–99 employees (27.8%), 75 companies with 100–199 employees (20.2%), and 36 companies with 200 employees or more (9.7%). Overall, the study's sample is well-balanced and representative of digital entrepreneurial ventures in the DEE.

### *4.2. Reliability and Validity Analysis*

Table 2 shows that for digital entrepreneurial ventures in the DEE, the Cronbach's $\alpha$ values for the variables and dimensions of sustainable entrepreneurial performance, entrepreneurial bricolage, business model innovation, and DEEE in this study are all above 0.7. This indicates that the scales used in this study have good reliability [54,55]. For the variables and dimensions of sustainable entrepreneurial performance, entrepreneurial bricolage, business model innovation, and DEEE, the factor loadings of the measurement items are all greater than 0.6, the Composite Reliability (CR) values are above 0.7, and the Average Variance Extracted (AVE) values are all greater than 0.5. Therefore, the scales used in this study have good convergent validity.

**Table 2.** Reliability and Convergent Validity Analysis Results.

| Variable | Variable Dimension | Number of Items | Dimension $\alpha$ Value | Variable $\alpha$ Value | Factor Loadings | CR | AVE |
|---|---|---|---|---|---|---|---|
| SEP | ECSP | 3 | 0.758 | 0.844 | 0.692~0.731 | 0.757 | 0.510 |
| | ENSP | 3 | 0.811 | | 0.754~0.797 | 0.814 | 0.593 |
| | SOSP | 4 | 0.852 | | 0.718~0.797 | 0.852 | 0.591 |
| EB | RB | 3 | 0.752 | 0.839 | 0.650~0.808 | 0.762 | 0.519 |
| | UB | 4 | 0.809 | | 0.688~0.742 | 0.809 | 0.515 |
| | IB | 4 | 0.832 | | 0.727~0.762 | 0.832 | 0.553 |
| BMI | EBMI | 6 | 0.904 | 0.874 | 0.768~0.795 | 0.904 | 0.611 |
| | NBMI | 6 | 0.893 | | 0.749~0.778 | 0.893 | 0.581 |
| DEEE | DE | 3 | 0.888 | 0.935 | 0.834~0.876 | 0.887 | 0.723 |
| | RE | 4 | 0.937 | | 0.868~0.909 | 0.938 | 0.790 |
| | SE | 4 | 0.935 | | 0.862~0.905 | 0.936 | 0.784 |

Note: SEP denotes sustainable entrepreneurial performance; ECSP denotes economically sustainable performance; ENSP denotes environmentally sustainable performance; SOSP denotes socially sustainable performance; EB denotes entrepreneurial bricolage; RB denotes resource bricolage; UB denotes user bricolage; IB denotes institutional bricolage; BMI denotes business model innovation; EBMI denotes efficiency-oriented business model innovation; NBMI denotes novelty-oriented business model innovation; DEEE denotes digital entrepreneurial ecosystem empowerment; DE denotes digital empowerment; RE denotes resource empowerment; SE denotes service empowerment.

To evaluate discriminant validity, it is required that the square root of the average variance extracted (AVE) for each construct exceeds the inter-construct correlation coefficients [56,57]. As illustrated in Table 3, the constructs in this study exhibit substantial correlations, yet the square root of the AVE for each construct surpasses the correlations with its associated constructs. Consequently, the measures employed in this study demonstrate robust discriminant validity.

**Table 3.** Discriminant Validity Analysis Results.

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. ECSP | **0.714** | | | | | | | | | | |
| 2. ENSP | 0.562 ** | **0.770** | | | | | | | | | |
| 3. SOSP | 0.342 ** | 0.326 ** | **0.769** | | | | | | | | |
| 4. RB | 0.479 ** | 0.426 ** | 0.535 ** | **0.720** | | | | | | | |
| 5. UB | 0.412 ** | 0.477 ** | 0.447 ** | 0.438 ** | **0.717** | | | | | | |
| 6. IB | 0.358 ** | 0.396 ** | 0.343 ** | 0.462 ** | 0.254 ** | **0.744** | | | | | |
| 7. EBMI | 0.461 ** | 0.545 ** | 0.285 ** | 0.420 ** | 0.360 ** | 0.309 ** | **0.782** | | | | |
| 8. NBMI | 0.411 ** | 0.312 ** | 0.344 ** | 0.292 ** | 0.255 ** | 0.263 ** | 0.260 ** | **0.762** | | | |
| 9. DE | 0.216 ** | 0.217 ** | 0.197 ** | 0.058 | 0.106 * | 0.008 | 0.353 ** | 0.284 ** | **0.851** | | |
| 10. RE | 0.199 ** | 0.207 ** | 0.187 ** | 0.058 | 0.198 ** | 0.034 | 0.226 ** | 0.200 ** | 0.578 ** | **0.889** | |
| 11. SE | 0.166 ** | 0.209 ** | 0.122 * | −0.009 | 0.071 | 0.008 | 0.202 ** | 0.179 ** | 0.602 ** | 0.586 ** | **0.885** |

Note: * $p < 0.05$ (two-tailed test), ** $p < 0.01$ (two-tailed test), diagonal elements in bold are the square roots of AVE values. ECSP denotes economically sustainable performance; ENSP denotes environmentally sustainable performance; SOSP denotes socially sustainable performance; RB denotes resource bricolage; UB denotes user bricolage; IB denotes institutional bricolage; EBMI denotes efficiency-oriented business model innovation; NBMI denotes novelty-oriented business model innovation; DE denotes digital empowerment; RE denotes resource empowerment; SE denotes service empowerment.

### *4.3. Common Method Bias Test*

To manage the potential for common method bias, strategies endorsed by Podsakoff et al. [58] include both preventive measures and subsequent statistical controls. For the former, the study's aims were explicitly outlined at the survey's commencement, with a focus on ensuring respondents' anonymity, clarity in the survey items to prevent misunderstandings, and a deliberate selection of a diverse sample across various geographical locations and DEE contexts. From the post hoc statistical test, all measurement items of the variables of sustainable entrepreneurial performance, entrepreneurial bricolage, business model innovation, and DEEE were subjected to exploratory factor analysis without rotation.

The findings indicate that the initial principal component accounts for 25.695% of the overall variance, falling below the threshold of 40%. This suggests that the issue of common method bias in this research is not significant.

### *4.4. Hypothesis Testing*

This study includes gender, age, education level, company age, and company size as control variables in the multiple linear regression model to construct an empirical regression model to test the research hypotheses. To assess the moderated mediation effect, bootstrap analysis, a technique where data is resampled extensively to determine the precision of estimates, is executed using the Process plugin in SPSS. According to Hayes [59], model 58 is used for testing the moderated mediation effect.

#### 4.4.1. Main Effect Test

From models 2 and 3, it can be seen that for digital entrepreneurial ventures in the DEE, entrepreneurial bricolage is significantly positively correlated with sustainable entrepreneurial performance ($\beta = 0.721$, $p < 0.001$), and business model innovation ($\beta = 0.628$, $p < 0.001$) also significantly positively affects sustainable entrepreneurial performance. Therefore, hypotheses H1 and H3 are established. From model 6, it can be seen that for digital entrepreneurial ventures in the DEE, entrepreneurial bricolage is significantly positively correlated with business model innovation ($\beta = 0.526$, $p < 0.001$). Therefore, hypothesis H2 is established.

#### 4.4.2. Mediation Effect Test

To analyze the mediating effect of business model innovation, business model innovation was added as an independent variable on the basis of model 2 to obtain model 4, as shown in Table 4. In the context of digital entrepreneurial ventures within the DEE, the addition of business model innovation to model 4, as opposed to model 2, diminishes the impact of entrepreneurial bricolage on sustainable entrepreneurial performance. This is evidenced by a change in the regression coefficient from $\beta = 0.721$ ($p < 0.001$) to $\beta = 0.539$ ($p < 0.001$). The decrease in the regression coefficient suggests that business model innovation exerts a partial mediating effect between entrepreneurial bricolage and sustainable entrepreneurial performance. Therefore, hypothesis H4 is established.

**Table 4.** Multiple Regression Analysis Results.

| Variable | SEP | | | | BMI | |
|---|---|---|---|---|---|---|
| | **Model 1** | **Model 2** | **Model 3** | **Model 4** | **Model 5** | **Model 6** |
| Gender | −0.024 | −0.036 | −0.016 | −0.029 | −0.013 | −0.022 |
| Age | −0.045 | −0.020 | −0.031 | −0.019 | −0.023 | −0.005 |
| Educational Attainment | 0.108 * | 0.043 | 0.088 * | 0.048 | 0.032 | −0.016 |
| Venture Age | −0.044 | −0.087 * | −0.033 | −0.070 | −0.017 | −0.049 |
| Venture Size | 0.048 | 0.071 | 0.018 | 0.048 | 0.049 | 0.065 |
| EB | | 0.721 *** | | 0.539 *** | | 0.526 *** |
| BMI | | | 0.628 *** | 0.346 *** | | |
| $R^2$ | 0.017 | 0.531 | 0.410 | 0.618 | 0.004 | 0.278 |
| Adjusted $R^2$ | 0.003 | 0.523 | 0.400 | 0.610 | −0.010 | 0.266 |
| F-value | 1.249 | 68.694 *** | 42.078 *** | 83.776 *** | 0.271 | 23.324 *** |

Note: * $p < 0.05$, *** $p < 0.001$. SEP denotes sustainable entrepreneurial performance; EB denotes entrepreneurial bricolage; BMI denotes business model innovation.

#### 4.4.3. Moderation Effect Test

The centered entrepreneurial bricolage is multiplied by the centered DEEE. Based on model 7, the product term is also added to the regression model to obtain Model 8, which is used to test the moderating effect of DEEE on the relationship between entrepreneurial bricolage and business model innovation. Table 5 shows that for digital entrepreneurial

ventures in the DEE, in Model 8, the product term of entrepreneurial bricolage and DEEE is significantly positively correlated with business model innovation (β = 0.324, $p < 0.001$). Thus, hypothesis H5 is supported. Similarly, the moderating effect of DEEE on the relationship between business model innovation and sustainable entrepreneurial performance is verified. Table 5 shows that for digital entrepreneurial ventures within the DEE, in Model 10, the product term of business model innovation and DEEE is significantly positively correlated with sustainable entrepreneurial performance (β = 0.258, $p < 0.001$). Thus, hypothesis H6 is supported.

**Table 5.** Moderating Effect Analysis Results.

| Variable | BMI | | SEP | |
|---|---|---|---|---|
| | **Model 7** | **Model 8** | **Model 9** | **Model 10** |
| Gender | −0.006 | −0.008 | 0.081 * | 0.096 * |
| Age | −0.095 | −0.068 | −0.003 | −0.033 |
| Educational Attainment | −0.022 | −0.065 | −0.015 | −0.014 |
| Venture Age | −0.015 | −0.028 | −0.032 | −0.014 |
| Venture Size | 0.039 | 0.055 | −0.018 | −0.017 |
| EB | 0.493 *** | 0.413 *** | | |
| DEEE | 0.310 *** | 0.151 ** | 0.069 | 0.145 ** |
| EB × DEEE | | 0.324 *** | | |
| BMI | | | 0.604 *** | 0.562 *** |
| BMI × DEEE | | | | 0.258 *** |
| $R^2$ | 0.379 | 0.448 | 0.414 | 0.475 |
| Adjusted $R^2$ | 0.367 | 0.435 | 0.403 | 0.463 |
| F-value | 31.630 *** | 36.671 *** | 36.679 *** | 40.923 *** |

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SEP denotes sustainable entrepreneurial performance; EB denotes entrepreneurial bricolage; BMI denotes business model innovation; DEEE denotes digital entrepreneurial ecosystem empowerment.

Figures 2 and 3 illustrate that with an increase in the degree of DEEE, the influence of entrepreneurial bricolage on business model innovation for digital ventures within the DEE is amplified. Similarly, the effect of business model innovation on sustainable entrepreneurial performance is also heightened. This suggests that the DEEE exerts a positive moderating influence on both the connection between entrepreneurial bricolage and business model innovation and the link between business model innovation and sustainable entrepreneurial performance.

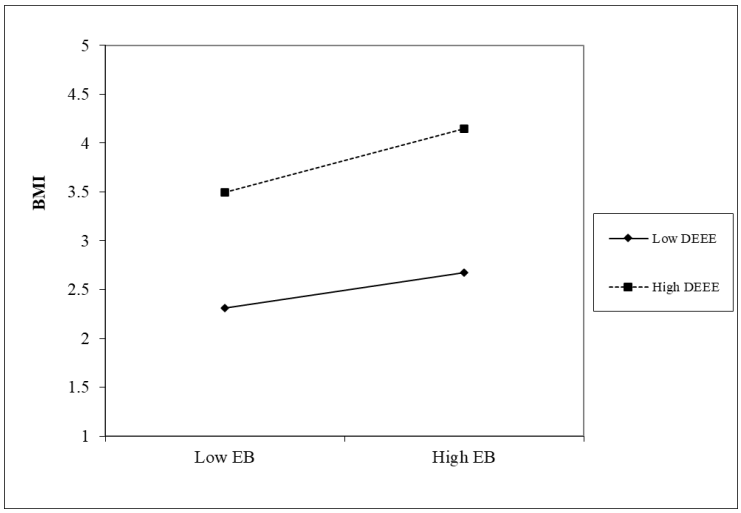


**Figure 2.** Moderating effect diagram of DEEE on the relationship between entrepreneurial bricolage and business model innovation.

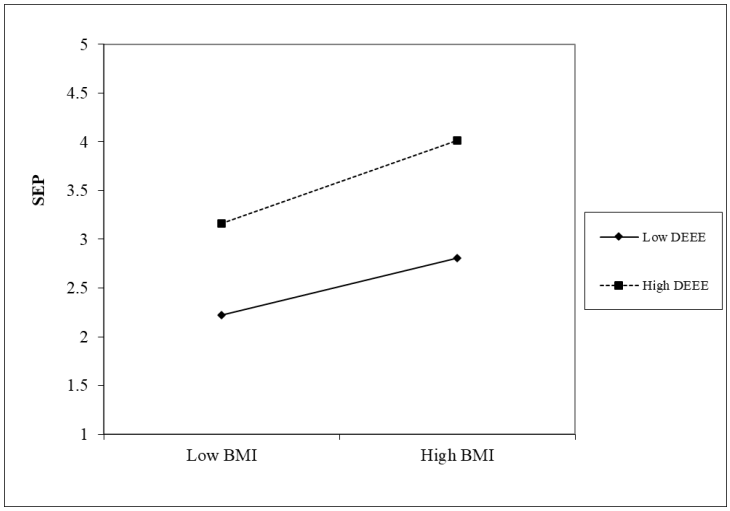


**Figure 3.** Moderating effect diagram of DEEE on the relationship between business model innovation and sustainable entrepreneurial performance.

#### 4.4.4. Moderated Mediation Effect Test

The mean of DEEE plus or minus one standard deviation is used as the grouping condition to distinguish the magnitude of the mediating role of business model innovation between entrepreneurial bricolage and sustainable entrepreneurial performance at different levels of DEEE. Table 6 shows that for digital entrepreneurial ventures with low levels of DEEE, the mediating effect value of business model innovation is 0.0296, with a confidence interval of [−0.0208, 0.0957], which includes 0, indicating a non-significant mediating effect; for digital entrepreneurial ventures with moderate levels of DEEE, the mediating effect value of business model innovation is 0.1476, with a confidence interval of [0.1011, 0.2007], which does not include 0, indicating a significant mediating effect; for digital entrepreneurial ventures with high levels of DEEE, the mediating effect value of business model innovation is 0.2705, with a confidence interval of [0.1621, 0.3947], which does not include 0, indicating a significant mediating effect. As the value of DEEE increases from low to high, the mediating effect value also increases, indicating that DEEE has a positive moderating effect on the indirect relationship between entrepreneurial bricolage and sustainable entrepreneurial performance through business model innovation. Thus, hypothesis H7 is supported.

**Table 6.** Analysis of the moderating effect of DEEE on the mediating role of business model innovation.

| Moderator Variable (DEEE) | EB->BMI->SEP | | | |
|---|---|---|---|---|
| | **Effect** | **Boot SE** | **Boot LLCI** | **Boot ULCI** |
| Low Value | 0.0296 | 0.0293 | −0.0208 | 0.0957 |
| Medium Value | 0.1476 | 0.0253 | 0.1011 | 0.2007 |
| High Value | 0.2705 | 0.0591 | 0.1621 | 0.3947 |

Note: SEP denotes sustainable entrepreneurial performance; EB denotes entrepreneurial bricolage; BMI denotes business model innovation; DEEE denotes digital entrepreneurial ecosystem empowerment.

## 5. Research Conclusions and Prospects

### *5.1. Research Conclusions*

Entrepreneurial bricolage is found to have a substantial and beneficial impact on sustainable entrepreneurial performance, and it also exerts a notable and favorable influence on business model innovation. In turn, business model innovation significantly and positively impacts sustainable entrepreneurial performance. For digital entrepreneurial ventures facing the dual dilemmas of "newborn weakness" and "small and weak", entrepreneurial bricolage has a positive impact on sustainable entrepreneurial performance. For digital entrepreneurial ventures within the digital entrepreneurship ecosystem, entrepreneurial

bricolage can assist in optimizing the utilization of existing resources and in conducting business model innovation under conditions of resource scarcity, which aligns with the findings of Guo et al. [20]. In the context of the digital era, an increasing number of enterprises are achieving cross-industry growth and even disrupting the competitive landscape of industries through business model innovation [21]. The business model innovation of digital entrepreneurial ventures can foster the enhancement of sustainable entrepreneurial performance, which is consistent with the research findings of Jenkinson et al. [35].

Business model innovation serves as a partial mediator in the relationship between entrepreneurial bricolage and sustainable entrepreneurial performance. For digital entrepreneurial ventures in the digital entrepreneurship ecosystem, there is a transmission effect of business model innovation in the process of entrepreneurial bricolage promoting the improvement of sustainable entrepreneurial performance. entrepreneurial bricolage can promote business model innovation [19,23], and business model innovation is an important antecedent for the improvement of sustainable entrepreneurial performance [21,45]. The impact of entrepreneurial bricolage on sustainable entrepreneurial performance is mediated through the process of business model innovation, thereby extending the research conclusions of Wu et al. [19] and Khattak et al. [45].

The digital entrepreneurship ecosystem empowerment positively moderates the relationship between entrepreneurial bricolage and business model innovation, and the relationship between business model innovation and sustainable entrepreneurial performance. The digital entrepreneurship ecosystem empowerment has a positive moderating effect on the indirect relationship of entrepreneurial bricolage affecting sustainable entrepreneurial performance through business model innovation. When the level of digital entrepreneurship ecosystem empowerment is high, entrepreneurial bricolage behavior promotes the implementation of business model innovation activities in ventures, and at the same time, a higher level of digital entrepreneurship ecosystem empowerment can stimulate the role of business model innovation, ultimately enhancing sustainable entrepreneurial performance [26,52]. Conversely, when the level of digital entrepreneurship ecosystem empowerment is low, it can hinder the conduct of entrepreneurial bricolage activities, the business model innovation of digital entrepreneurial ventures may not be realized, and the sustainable entrepreneurial performance may also find it difficult to significantly improve.

### *5.2. Theoretical Contributions*

Firstly, it expands the application of entrepreneurial bricolage and business model innovation theories in the context of digital entrepreneurship. Digital entrepreneurship research is still in its infancy, and there is no consensus on the connotation and composition of digital entrepreneurship, but the widespread impact of digital technology on entrepreneurship has been unanimously recognized by scholars. Digital entrepreneurship resources and digital business models differ from traditional entrepreneurship and are worth further research [60]. Due to unclear basic concept definitions and the difficulty of grasping the digital entrepreneurship context, relevant research is relatively scattered, research conclusions are not consistent, and theoretical research on digital entrepreneurship is still lagging behind practical development [24,61]. Considering the dearth of empirical studies in the realm of digital entrepreneurship, this research focuses on digital entrepreneurial ventures to empirically investigate how the empowerment of the digital entrepreneurship ecosystem influences the mechanism by which entrepreneurial bricolage and business model innovation contribute to sustainable entrepreneurial performance.

Secondly, it develops a cohesive framework that examines how digital entrepreneurship ecosystems enhance the link between entrepreneurial bricolage, business model innovation, and sustainable entrepreneurial performance. While earlier studies have predominantly concentrated on the immediate effects of entrepreneurial bricolage on performance [62,63], there is a scarcity of research that delves into its role in fostering sustainable entrepreneurial performance. Additionally, the mediating mechanisms at play have been

largely overlooked, and the influence of digital entrepreneurship ecosystem empowerment on these dynamics has received minimal consideration. In-depth research from the perspective of business model innovation is conducive to revealing the black box of the mechanism by which entrepreneurial bricolage affects sustainable entrepreneurial performance. By exploring the integrated model of the relationship between entrepreneurial bricolage and sustainable entrepreneurial performance under the empowerment of the digital entrepreneurship ecosystem, this study makes up for the current lack of research on the integrated model of the mechanism of the role of entrepreneurial bricolage and sustainable entrepreneurial performance.

Thirdly, it empirically explores the moderating effect of the digital entrepreneurship ecosystem empowerment, enriching the empirical research results related to the digital entrepreneurship ecosystem. At present, there are very limited studies on digital entrepreneurship based on the ecosystem level, and there are even fewer studies on how the digital entrepreneurship ecosystem affects digital entrepreneurial ventures. Some scholars have proposed that the digital entrepreneurship ecosystem can have an impact on the digital entrepreneurship process [52,64], but there is a lack of related empirical research. This research innovatively incorporates the lens of digital entrepreneurship ecosystem empowerment to investigate its moderating influence on the interplay among entrepreneurial bricolage, business model innovation, and sustainable entrepreneurial performance, thereby expanding the empirical findings within the domain of digital entrepreneurship ecosystems. Quantitative analysis of the role of digital entrepreneurship ecosystem empowerment helps stakeholders make strategic choices and optimizations, thereby promoting the high-quality development of the digital entrepreneurship ecosystem.

### *5.3. Managerial Implications*

Firstly, digital entrepreneurial ventures in the digital entrepreneurship ecosystem should actively enhance their entrepreneurial bricolage capabilities. Digital entrepreneurial ventures in the ecosystem should act immediately and respond quickly according to their own capabilities and characteristics, implement entrepreneurial bricolage strategies, seize new opportunities in the digital market in a timely manner, develop unique business models, and establish competitive advantages.

Secondly, ventures within the digital entrepreneurship ecosystem are encouraged to proactively engage in business model innovation. Such innovation is pivotal for businesses to develop and maintain a sustainable edge in the competitive landscape. Under the context of digital economic development, digital entrepreneurial ventures in the ecosystem should achieve cross-industry growth and even disrupt the competitive landscape of industries through business model innovation to promote the improvement of sustainable entrepreneurial performance.

Then, digital entrepreneurial ventures need to make full use of the empowerment of the digital entrepreneurship ecosystem. Before joining the digital entrepreneurship ecosystem, digital entrepreneurial ventures can choose a suitable ecosystem through multi-faceted research to fully utilize the empowerment effect provided by the ecosystem, to overcome resource shortages and legitimacy deficiencies more quickly, and achieve sustainable development.

Lastly, the digital entrepreneurship ecosystem should fully exert its empowering role. The ecosystem should accelerate the construction of digital infrastructure, use digital technology to improve management and service capabilities, promote the integration and sharing of digital entrepreneurship elements, provide entrepreneurial guidance services for digital entrepreneurial ventures, fully exert its empowering role for digital entrepreneurial ventures, and promote the sustainable development of digital entrepreneurial ventures.

### *5.4. Research Limitations and Prospects*

Firstly, the integrated model has its limitations. Future research can further explore whether new mediators and moderators can be incorporated into this model, introduce

new perspectives, enrich the theoretical model, and derive management insights that help enhance the sustainable development performance of digital startups. Additionally, this study focuses on exploring the relationship between entrepreneurial bricolage and the sustainable development performance of startups, without in-depth discussion on the antecedents of entrepreneurial bricolage. Future research can enrich the study of antecedent variables of entrepreneurial bricolage, incorporate them into the model, and further enrich and perfect the integrated framework proposed in this study.

Secondly, there are limitations regarding the survey sample. This study selects the Yangtze River Delta region in China as the research area. Future research can expand the survey sample region, enhance the universality of the study by analyzing survey sample data from more areas. Based on this, future research can also conduct comparative analyses of samples from different regions, compare differences between samples from various regions, and delve into the reasons for these differences. Moreover, future research can further increase the number of survey samples, analyze data from more survey samples, and further validate the conclusions of this study.

Thirdly, there are limitations in the research process. Future studies could analyze the dynamic impact of entrepreneurial bricolage on the sustainable development performance of digital startups through longitudinal tracking, incorporate the entire entrepreneurial process into the research, explore the effectiveness of entrepreneurial bricolage at different stages of the business life cycle, and investigate the deep-seated reasons for the differences in the effects of entrepreneurial bricolage.

**Author Contributions:** Conceptualization, X.L. and L.Z.; Methodology, X.L. and L.Z.; Validation, X.L.; Formal analysis, X.L.; Investigation, X.L. and L.Z.; Resources, X.L.; Data curation, X.L. and L.Z.; Writing—original draft, X.L.; Writing—review & editing, X.L. and L.Z.; Visualization, X.L.; Supervision, X.L.; Project administration, X.L.; Funding acquisition, X.L. and L.Z. All authors have read and agreed to the published version of the manuscript.

**Funding:** This work was supported by Youth Project of the National Social Science Foundation (21CJY024), Youth Fund Project of the Humanities and Social Sciences Research Planning Project of the Ministry of Education (23YJC710119), the Key Project of the Higher Education Science Research Planning of the Chinese Society of Higher Education (23XC0308), Zhejiang Provincial Soft Science Research Program Project (2024C35087), Hangzhou Social Science Planning Project of China Chain Research Center (24JD020), and the Fundamental Research Funds for the Provincial Universities of Zhejiang (QR202309).

**Institutional Review Board Statement:** Ethical review and approval were not required for this research in accordance with local regulations and institutional policies, which do not mandate ethical assessment for this type of study. Participants were presented with an informed consent section at the questionnaire's onset, outlining the study's objectives, guaranteeing anonymous data collection, and confirming that the information would not be utilized for commercial ends.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

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

**Conflicts of Interest:** The authors declare that they have no conflict of interest.

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