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How can the Digital Economy Boost the Performance of Entrepreneurs? A Large Sample of Evidence from China's Business Incubators

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Abstract: The digital economy enabled by digital technologies is reshaping economic and social development, bringing a digital revolution to entrepreneurship and innovation. Does the digital economy realistically translate into excellence in microentrepreneurial ventures, and do business incubators still play an important role in the digital era? There is a lack of sufficient evidence in this area. This study combines macro and micro perspectives, economics, and management perspectives and examines the relationship between regional digital economy development and incubates performance using a panel fixed effects model based on a large sample of data from Chinese technology business incubators and their incubates. Robustness tests were also conducted by the instrumental variable's method and other conventional methods, and the stepwise regression method was used to set up a mediating effect model of incubation service support to test the mechanism of the impact of the digital economy on the performance of incubated enterprises. The results of this study show that the development of the digital economy in cities helped improve the revenue capacity of startups, and the more developed the digital economy is, the better the financial performance of startups performs. From a resource-based view, resource service support from incubators, such as capital, technology, human resources, and knowledge, is an important channel through which the digital economy promotes the performance of startups. This study provides new perspectives and additions to theoretical and empirical studies of the digital economy and entrepreneurship development and provides policy and management insights for the development of the business incubation industry from the digital economy perspective.

Keywords: digital economy; business incubator; entrepreneurial services support; entrepreneurial performance; mediating effect

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1. Introduction

The profound impact of the digital economy is all-encompassing and disruptive, inducing both a new round of entrepreneurial innovation booms and triggering paradigm shifts in entrepreneurial innovation. The rapid advancement and widespread adoption of digital technologies, digital platforms, and digital infrastructure drive the digital transformation of entrepreneurship and innovation; furthermore, they are not only providing new opportunities for entrepreneurs but also are changing the logic of value creation and value capture (Yoo, Henfridsson & Lyytinen, 2010; Nambisan, Wright & Feldman, 2019) [1,2]. The economic and social environment in which entrepreneurship is practiced and the entrepreneurial activity itself has undergone significant changes, and a number of new phenomena and questions have emerged that are difficult to answer through existing theories and entrepreneurship research; such phenomena and questions are prominent in the Chinese context, but the current research has failed to give sufficient attention and responses to them (Zhou, D.M., Chen, X. L., Yang, J. & Lu, R.Y. 2020) [3]. Therefore, it is of great practical and theoretical importance to deeply study the mechanisms of the digital economy's impact on entrepreneurial activities and startup performance.

Entrepreneurship and innovation are considered important ways for the digital economy to drive high-quality economic development (Zhao, T., Zhang, Z. & Liang, S.K., 2020; Yu, D.H. & Wang, M.J., 2022; Zhang, Y.H., Wang, M.F. & Liu, T.T., 2022) [4–6], and business incubators, gas pedals, and university science and technology parks are considered important policy tools in supporting technology entrepreneurship and innovation (Mian, Lamine & Fayolle, 2016; Lai, W.H.& Lin, C.C., 2015) [7,8]. Therefore, how can digital economic development influence incubators' entrepreneurial service support and thus improve startup performance? The situation may vary across countries and regions. As a large emerging economy, China has become the secondlargest digital economy after the United States. The digital economy and entrepreneurship environment are constantly improving, but there is still a considerable gap between digital public services and entrepreneurial development. China's GTMI ranked 79th in the "GovTech Maturity Index report 2022" of the World Bank, which assessed the capacity and progress of 198 countries and regions in promoting digital transformation by their governments (WBG, 2022) [9]. According to the "Global Entrepreneurship Monitor 202/2023" report, China ranks 11th among 49 economies in the entrepreneurship environment index, but the proportion of adults aged 18–63 who start their own businesses ranks lower. Whether through Total early-stage Entrepreneurial Activity (TEA) or Established Business Ownership (EBO), the proportion of entrepreneurship in China is relatively low (GEM, 2023) [10]. The entrepreneurship incubation industry is also not optimistic China's technology business incubators have an overall low operational efficiency and less-than-ideal incubation performance. Entrepreneurial SMEs are more resource-constrained, mostly struggling for survival, and their startup success rates are generally not high. Entering the digital economy, it remains to be seen whether China's business incubation industry has fully shared the digital dividend.

There is a large body in the literature with two main perspectives around the impact of the digital economy on entrepreneurship. First, an economic perspective that focuses on how the digital economy can facilitate or stimulate entrepreneurial development. A large body of evidence suggests that a country's digital economy or level of digitization has a significant positive impact on entrepreneurship development (Galindo-Martin, Castano-Martinez & Méndez-Picazo, 2019; Jafari-Sadeghi, Garcia-Perez, Candelo, & Couturier, 2021; Sadigov, 2022) [11–13], and digital economy development can significantly increase entrepreneurial activity (Zhao, T., et al., 2020; Zhao, X.Y. & Yi, C.J., 2022; Zou, Q. & Fan, L., 2022) [4,14,15]. Such studies are mostly conducted at the macro level. The second is the management perspective, which focuses on how the digital economy changes or reshapes entrepreneurial activities. With digital technology deeply embedded in the process of entrepreneurship, digital entrepreneurship has become a new form of entrepreneurship (Guo, H. & Yang Z.E., 2021) [16], and the study of digital entrepreneurship in different economic, institutional, cultural contexts, or micro perspectives has become the focus of scholars' attention (Hull, Hung, Hair, Perotti & DeMartino, 2007; Nambisan, 2017; Yu, J., Meng, Q.S., Zhang, Y. & Jin, J., 2018; Zhu, X.M., Liu, Y. & Chen, H.T. 2020) [17–20]. The characteristics, subjects, motivations, networks, processes, and outcomes of entrepreneurship in digital scenarios have been the focus of the research. Unfortunately, empirical studies combining the above two perspectives to explore how the digital economy affects startup performance are insufficient, and micro evidence from a Chinese context is lacking. There is much room for deeper research when business incubation support is taken into account.

In view of this, this paper combines macro-level economic perspectives with micro-level management perspectives to construct a theoretical analysis framework between the digital economy and entrepreneurial firms, matching a large sample of Chinese incubators and incubatees with city statistics to empirically test the mechanism and the impact of regional digital economy developments on the performance of incubatees. The possible marginal contribution of this study includes (1) theoretical insights into the theoretical basis of the digital economy's impact on microentrepreneurial activities and verification of the direct and indirect effects of the digital economy on incubatees' performance, which may be heterogeneous for incubators and startups with different characteristics, with business incubation support being an important mediating channel. These relevant reflections and findings help expand the boundaries of digital economy development theories and enrich theoretical and empirical studies on the digital economy and entrepreneurship innovation. (2) On the practical side, empirical analysis based on a large sample of data from Chinese incubators not only obtain more convincing new evidence to assess the development effectiveness of China's digital economy and business incubation industry but also provides new policy guidance for accelerating the development of the digital economy and promoting entrepreneurship and innovation in emerging economies in addition to obtaining new practical insights for incubators to strengthen business incubation support and the healthy growth of startups.

2. Theoretical Background and Research Hypothesis

2.1. Connotation and Characteristics of Digital Economy

It is generally believed that the concept of the digital economy was first proposed by Tapscott (1996) in his book "The Digital Economy: Promise and Peril in the Age of Networked Intelligence", but up to now, there has been no unified definition. From the perspective of relevant concepts, the digital economy and the new economy, information economy, network economy, knowledge economy, e-commerce, and platform economy are both in one continuous line but also have differences. According to the content and scope, the digital economy can be divided into a narrow definition and a wide definition. The U.S. Department of Commerce's Bureau of Economic Analysis mainly defines a digital economy based on the Internet and related information and communication technology (ICT) and insists that it consists of digital infrastructure, e-commerce, and digital media (Barefoot, Curtis, Jolliff, Nicholson & Omohundro, 2018) [21]. The OECD (2014) [22] also focuses on the role and application of ICTs and divides the digital economy into data infrastructure, ICT investment and innovation capability, and ICT promoting economic growth and social progress. The IMF (2018) [23] focuses on the digital sector and believes that the digital economy includes the core activities of digitization, ICT goods and services, online platforms, and platform-enabled activities. All these are typical narrow-caliber definitions. The European Union's understanding of the digital economy is slightly broader. The EU's Digital Economy and Society Index (DESI) measures the development level of the digital economy of EU member countries in terms of connectivity, human capital, the use of internet services, integration of digital technology, digital public services, and other aspects.

The representation of a broad and wide definition is defined in the G20 Digital Economy Development and Cooperation Initiative adopted at the G20 Hangzhou Summit in 2016, which states that the digital economy is a series of economic activities that use digital knowledge and information as key production factors, modern information networks as an important carrier, and the effective use of information and communication technology as an important, driving force for efficiency improvement and economic structure optimization. The consensus among Chinese officials and academia is similar to this. Generally, the digital economy can be divided into two aspects: digital industrialization and industrial digitalization. The former refers to the digital core sector (approximately equal to the ICT industry), and the latter refers to the digital transformation of other traditional industries.

With the iterative innovation of digital technology, the digital economy shows some new features that are different from traditional economic forms: (1) Digitalization. Digital technology applications become a key capability, and data become a key production factor. (2) Networking. The continuous development of information network infrastructure makes it possible to obtain an internet of everything, and enterprises can break the time and space constraints to plan operations and allocate resources. (3) Intelligence. The development and application of digital technologies, such as the Internet, big data, artificial intelligence, blockchain, and digital twin, make production and lifestyle more intelligent and smarter.

(4) Integration. Digital technology gradually penetrates from the ICT sector to other real economic sectors, integrates from online to offline, extends from the consumer side to the production side, and cross-border integration becomes the norm. (5) Ecosystemization. With digital platforms and platform enterprises as the core, many SMEs (small, medium, and micro enterprises) and massive users are brought together to participate, interact in real-time, and collaborate in innovation, forming an open and symbiotic digital ecosystem. It is due to the above characteristics that the digital economy provides new opportunities and space for innovation and entrepreneurship and constantly gives rise to new business models, organizational methods, and industrial formats. In addition to the traditional ICT sector, the application of digital technology in various industries, such as industry, agriculture, and the service industry, is constantly evolving. New business models such as intelligent manufacturing, intelligent agriculture, intelligent business, smart transportation, and smart medical care are emerging.

Since this paper focuses on the impact of the digital economy on entrepreneurship, when defining the development of the digital economy, it uses a narrow definition of digital core sectors for measurement (such as digital infrastructure, ICT employment, innovation and entrepreneurship, digital finance, etc.).

2.2. The Dual Impact of the Digital Economy on Entrepreneurship

With the iterative innovation and widespread use of digital technologies, an increasing number of startups and entrepreneurial activities are somehow and to some extent connected to the digital economy. The impact of the digital economy on entrepreneurship driven by digital technologies is a dynamic evolutionary process from surface to surface, from quantitative to qualitative changes, and therefore, it is the result of both quantitative and qualitative effects.

On the one hand, the digital economy has a positive impact on entrepreneurship development at the quantitative level. The digital economy has contributed to more entrepreneurial activity by influencing factors such as opportunity, willingness, cost, and the environment of entrepreneurship. Studies have shown that the digital economy enhances entrepreneurial enthusiasm in the labor market, and both survival and opportunity entrepreneurship show significant growth as a result, with opportunity entrepreneurship being affected to a greater extent (Liu, C.H., 2022) [24]; the development of digital technology, especially artificial intelligence, creates opportunities for growth entrepreneurship but increases the opportunity cost of survival entrepreneurship (Fossen & Sorgner, 2021) [25], and the willingness of college students to start a business is enhanced by the digitization of the economy (Youssef, Boubaker, Dedaj & Carabregu-Vokshi, 2021) [26]; digital technologies such as the internet, big data, cloud computing, and digital finance, which also help reduce the production costs and transaction costs of businesses and provide opportunities for information. Digital platforms and related ecosystems provide a promising new environment for entrepreneurship (Nambisan & Baron, 2021) [27], and core industries of the digital economy (digital technologies, products, services, infrastructure, and solutions, etc.) and the many areas where digital technologies and the real economy are integrated and developed are hotbeds for entrepreneurship.

On the other hand, the digital economy has brought about a paradigmatic change in entrepreneurship at the level of qualitative change. Emerging digital technologies have changed uncertainty in the entrepreneurial process and outcome; the way uncertainties are handled results in the new phenomenon of digital entrepreneurship (Nambisan, 2017) [18]. Digital entrepreneurship implies the digitization of entrepreneurial organizations, entrepreneurial processes, and outputs (Hull et al., 2007; Yu J. et al., 2018) [17,19], and it is the entrepreneurial activity of digital entrepreneurs who identify and develop digital entrepreneurial opportunities, lead or follow into digital markets, and create digital products and digital services (Zhu, X.M., et al., 2020) [20]. The elements, organization, and mechanism of digital entrepreneurship have new characteristics that are different from those of traditional entrepreneurship, such as the fragmentation of entrepreneurial opportunities, the diversification of entrepreneurial subjects, the platformization of entrepreneurial organizations, the virtualization of entrepreneurial networks, lowering entrepreneurial costs and resource acquisition thresholds, and more prominent market and user orientation (Yu, J., et al., 2018; Zhu, X.M., et al., 2020) [19,20]. This is particularly evident in the IT sector of artificial intelligence, where digital technologies can empower the process of identifying, developing, and exploiting entrepreneurial opportunities, and artificial intelligence can transform entrepreneurial activities in terms of organizational design decision-making systems, entrepreneurial goals, and market development (Briel, Davidsson, & Recker, 2018; Chalmers, MacKenzie & Carter, 2021) [28,29]. As digital technologies continue to permeate and change entrepreneurial behavior and outcomes at multiple levels from individuals, firms, and ecosystems (Cai, L., Yang, Y.Q., Lu, S. & Yu, H.J., 2019) [30], they naturally lead to a number of other important topics, including but not limited to digital entrepreneurial ecosystems (Sussan & Acs, 2017; Du, W., Pan, S.L., Zhou, N. & Ouyang, T. 2018; Bouncken & Kraus, 2021) [31–33], agile or lean business models (Ghezzi & Cavallo, 2020; Balocco, Cavallo & Ghezzi, 2019) [34,35], and digital social entrepreneurship (Battisti, 2019; Ghatak, Chatterjee & Bhowmick, 2020; Liu, Z.Y., Zhao, C.F. & Li, B., 2020) [36–38].

The digital economy brings both quantitative and qualitative changes to entrepreneurship, both of which contribute to the rapid growth and expansion of startups. Higher entrepreneurial activity is a prerequisite guarantee for the digital economy to promote the growth of startups. The more opportunities, lower costs, richer scenarios, and friendlier environments there are for entrepreneurship across society, the more favorable it will be for startups to develop. Whether it is the digital economy or other fields of entrepreneurship, whether it is digital entrepreneurship or traditional entrepreneurship, they all are able to enjoy the development dividend of the digital economy, and companies that adopt digital technology for digital innovation and entrepreneurship usually grow up at a faster pace.

2.3. Digital Economy Development and Entrepreneurial Performance

Regions with a rapidly growing digital economy tend to be very entrepreneurial, with startups able to access entrepreneurial support and improve business performance in a friendlier environment. The practice in European countries shows that digital transformation and digital dividends have a positive impact on technology entrepreneurship and technology market expansion (Galindo-Martin et al., 2019; Jafari-Sadeghi et al., 2021; Sadigov, 2022) [11–13]. The experience of the development of Industry 4.0 in Russia shows that the use of human capital and artificial intelligence with the help of AI-assisted decision-making and the rationalization of the ratio between the use of human capital and AI is conducive to improving the efficiency of social entrepreneurship (Popkova & Sergi, 2020) [39]. There is sufficient evidence that the development of China's digital economy has significantly increased entrepreneurial activity (Zhao, T. et al., 2020; Yu, D.H. & Wang, M.J., 2022; Zhang, Y.H., et al., 2022; Zhao, X.Y. & Yi C.J., 2022; Zou, Q. & Fan, L., 2022) [4–6,14,15] and that the platform economy and odd job economy have driven entrepreneurship in finance, information, research, and human resources industries such as entrepreneurship (Mo, Y.Q. & Li, L.X., 2022) [40], information infrastructure construction (Meng, H.W., Zhao, H.P. & Zhang, S.D., 2022; Kong, L.C. & Zhang, Z., 2020) [41,42], digital inclusive finance development (mobile payment, etc.) (Xie, X.L., Shen, Y., Zhang, H.X. & Guo, F. 2018; Zhang, X., Wan, G.H., Zhang, J.J. & He, Z.Y., 2019; Yin, Z., Gong, X., Guo, P. & Wu, T., 2019; Li, X.Y. & Liu, Y.M., 2021) [43–46], digital skills and literacy enhancement for the whole population, which are all positive factors from which to promote entrepreneurship; moreover, regional pilot demonstration policies such as big data and intellectual property rights can also effectively stimulate entrepreneurship (Zou, Q. & Fan, L., 2022; Zhao, F.S. & Li, L., 2021) [15,47].

The impact of the digital economy on startup performance is the result of a combination of factors that cut across all aspects and processes of entrepreneurial activity and is essentially a concrete manifestation of the active embrace of digital transformation by entrepreneurs and stakeholders.

2.3.1. Startup Cost and Efficiency

The digital economy has prompted entrepreneurs to commonly adopt digital technologies and tools such as the internet, big data, cloud computing, artificial intelligence, and blockchain, forcing enterprises to build flat, agile, and platform-based organizational structures, thereby reducing information acquisition, communication, and coordination costs (Yu, J., et al., 2018) [19]; using digital finance and other means to broaden borrowing channels and reduce financing costs; and relying on digital platforms to reduce transaction costs and improve resource allocation efficiency. Of course, the skills and capabilities of individual entrepreneurs are also critical in reducing start-up costs and improving operational efficiency (Nambisan & Baron, 2021) [27].

2.3.2. Entrepreneurial Resources and Capabilities

The digital economy provides startups with convenient access to digital resources and capabilities such as information, data, and cloud services and can alleviate the financing difficulties of SMEs through digital inclusive finance (Xie, X.L., et al., 2018; Zhang, X., et al., 2019) [43,44], while also helping to guide enterprises to use digitalization to strengthen R&D investment and improve innovation efficiency, as well as to motivate more highly educated and qualified talent to participate in entrepreneurship, thus optimizing the employee structure and improving labor productivity. Entrepreneurial SMEs can enhance their network capabilities and improve business performance by accessing digital platforms (Cenamor, Parida & Wincent, 2019) [48], integrating entrepreneurial resources, and building dynamic capabilities based on a combination of online and offline approaches have been shown as proven options.

2.3.3. Entrepreneurial Process and Output

The digital economy has blurred the boundaries between the stages of the entrepreneurial process and entrepreneurial output, making entrepreneurship less constrained by predetermined plans and physical space (Nambisan, 2017) [18], with digital technologies becoming more deeply embedded in the entrepreneurial process and digital products and services accounting for an increasing share in the entrepreneurial output. Despite the differences in the degree of transition from traditional to digital entrepreneurship, the business models of digital entrepreneurship, whether transformative, convergent, or comprehensive (Hull et al., 2007; Zhu, X.M., et al., 2020) [17,20], involve the exploitation of digital resources and the development, promotion, and dynamic renewal of digital products and services to gain competitive advantage in opportunity identification, agile innovation, and market development. For digital start-ups, business model innovation can directly or indirectly enhance firm performance (Guo, H., Guo, A. & Ma, H., 2022; Gupta & Bose, 2022) [49,50].

2.3.4. Entrepreneurial Ecosystem and Policies

The digital economy provides effective support to start-ups or entrepreneurial teams by changing the entrepreneurial ecosystem and the entrepreneurial policies of local governments. The development and governance of the entrepreneurial ecosystem benefit from the effective use of digital technologies and depend on the discovery of new entrepreneurial opportunities and business models through digital technologies (Bouncken & Kraus, 2022) [33], and the entrepreneurial ecosystem in the digital era particularly emphasizes the acquisition of digital capabilities based on digital availability (digital affordances) (Autio, Nambisan, Thomas & Wright, 2018) [51]; this is an important condition on which startups to should grow and thrive. The rapid development of the digital economy also enables entrepreneurs to receive increasingly effective preferential policy support. In the context of the accelerated digital transformation process, emerging economies such as China, India, Brazil, and Russia have invariably made the introduction of entrepreneurial incentives an important option, expecting a response to entrepreneurial demands and stimulating entrepreneurial innovation (Jawad, Naz & Maroof, 2021) [52].

It has been shown that the four effects of information channels, financing, social interaction, and risk appetite are important channels through which internet use promotes household entrepreneurship in China (Zhou, G.S. & Fan, G., 2018) [53], which is an important mechanism of digital technology-enabled entrepreneurship, and thus these effects easily shape access to information and financing channels, efficient information and social interactions, robust risk appetite, and a fair and friendly business environment, thereby helping startups innovate their business models and achieve market success (Gupta & Bose, 2022) [50].

Based on the above analysis, this paper proposes Hypothesis H_1: regional digital economy development is positively related to startup performance (e.g., total revenue), i.e., the higher the level of digital economy development in a region, the more favorable it is for startups to improve their financial performance.

2.4. The Mediating Role of Incubators' Entrepreneurial Service Support

A rise in the digital economy has brought a wave of rapid development to the business incubation industry. Business incubation platforms such as incubators, gas pedals, university science and technology parks, and crowdsourcing spaces are the core hubs that make up the entrepreneurial ecosystem and are key carriers that link the entrepreneurial and innovation resources and carry incubation service support. In the process of promoting the growth of startups in the digital economy, can business incubation support from physical platforms such as incubators play a positive role? The answer should be yes, but there are few empirical studies supporting this in the Chinese context, and the few that have been published have argued the key role of incubators (Shi, P.R., Cao, J.Y. & Jia, J., 2022) [54], crowdsourcing spaces (Fan, L.F. & Wang, M.S., 2022) [55], and university science and technology parks (Jiang, J.X., Tang, Y.C. & Li, L.P., 2022) [56] from different perspectives. However, in terms of research, such studies are not satisfactory in terms of their targeting, sample representativeness, and analytical framework.

The success of a startup depends not only on the firm's own characteristics but also on incubation support from the city where the firm is located and the business incubation platform. Evidence from Chinese incubators suggests that incubatees' own resources have the strongest impact on incubation performance incubator resources are the second strongest, with city resources appearing the weakest, thus giving incubators a greater value of existence (Yuan, X.F., Guo, H.C. & Liu, Y.P., 2022) [57]. Incubators' physical/tangible resources (infrastructure, human capital, finance, etc.) and intangible resources (e.g., consulting services) have different degrees of influence on incubation performance (Yuan, X.F., et al., 2022) [57], technical services, financial services, entrepreneurial coaching, and specialized services (Xiao, L. & North, D., 2018) [58], or support such as networks, funding, and equipment (Mian et al., 2016) [7], all of which can help startups survive and grow. The resource and program service capabilities of incubators are critical to long-term business development, with resource services such as human resources, intellectual property, capital, network, space, equipment, and program services such as business plans, execution strategies, and institutionalization all contributing to the entrepreneurial success (Lai, W.H. & Lin, C.C., 2015) [8]. Incubators and their incubation support in the Yangtze River Delta region of China are indeed an important channel for promoting technology entrepreneurship in the digital economy (Shi, P.R., et al., 2022) [54].

Grounded in a resource-based view, the digital economy can improve the performance of incubatees by strengthening incubators' resource support in terms of funding, technology, talent, and knowledge. As a resource aggregation and entrepreneurial service platform, the most important function of an incubator is to provide resource coordination and management consulting services to entrepreneurs. Incubators use resource coordination as an important tool to shape the competitiveness of companies and can help organizations to better target information, operations, and IT management issues in three dimensions: business, strategy, and structure, allowing companies to obtain efficient resource management capabilities, reduce operational costs, improve operational efficiency and enhance the competitiveness of their products/services.(Lopes da Costa, R., 2011) [59].

2.4.1. Funding Resource Support (FRS)

Entrepreneurial activity, especially digital entrepreneurship, is highly dependent on the support of angel investors and venture capital funds (VC) (Cavallo, Ghezzi, Dell'Era & Pellizzoni, 2019) [60]. The entrepreneurial boom and industrial investments brought about by the digital economy have led to unprecedented activity in entrepreneurial investment and financing, with incubators forming specialized venture capital or incubation funds to provide platforms, channels, information, and services with investment and financing. Alongside the backing of incubators, incubatees are more likely to benefit from digital financial inclusion (Jiang, J.X., et al., 2022) [56] and have easier access to financing services such as an angel or venture capital, incubation funds, etc.

2.4.2. Technical Resource Support (TRS)

Technical support from incubators can promote enterprises' patent output and technology project implementation (Xiao, L. & North, D., 2018) [58] and improve their R&D efficiency and innovation capacity. In the digital economy environment, incubators generally provide technical service support for the innovation and development of incubated enterprises by building and operating public technology platforms or digital technology platforms, leading or participating in the formation of innovation consortia, open-source communities, or other collaborative innovation platforms. The potential of digital technologies and digital platforms for enhancing entrepreneurial performance has been proven (Cenamor, Parida & Wincent, 2019; Chatterjee, Chaudhuri, Vrontis & Thrassou, 2022) [48,61].

2.4.3. Human Resource Support (HRS)

The human resources that an incubator can provide are the most important and have the greatest impact on incubation performance (Yuan, X.F., et al., 2022) [57]. Human resource support includes two types: first, the incubator's management service staff, including mainly business mentors and technical and management experts; second, reliance on the platform, resources, and brand advantages of the incubator to attract and reserve various types of talent for incubatees, such as technical and digital talent. In general, highly educated managers can strengthen the positive effect of the digital economy (mainly digital finance) on incubation performance (Jiang, J.X., et al., 2022) [56], and the more highly qualified talent an incubator brings together, the more beneficial it can be to the growth of incubatees.

2.4.4. Knowledge Resource Support (KRS)

Entrepreneurship means facing risks and challenging the unknown, and the knowledge and skills of entrepreneurs need to be constantly updated. These necessary skills and knowledge can be acquired either through formal education, professional training, or specific experience (Fayolle & Gailly, 2015) [62] or through knowledge services that have residency in incubators and organizational learning (Liang, Q. & Su, T.Y., 2022) [63]. The digital economy requires entrepreneurs to provide a sharper ability to identify and grasp opportunities and also puts forward more and higher requirements for the consulting and knowledge service capabilities of incubators. Combined with the new opportunities and new scenario-based demands brought by the digital economy, incubators can provide entrepreneurs with entrepreneurship guidance and training, and professional services such as intellectual property rights, laws, and policies can help them acquire entrepreneurial knowledge and business abilities.

Despite the differences in how incubation organizations operate and the scope of their services, it is well established that diverse incubators help start-ups grow by providing entrepreneurial service support (Grimaldi & Grandi, 2005) [64]. Research from the Chinese context suggests that incubators also have long-term mechanisms to promote business innovation, including human capital, financing constraints, and transmission channels for the transformation of scientific and technological achievements (Wang, K., Li, Y.F., Li, J. & Zhao, Y.Y., 2019) [65]; moreover, they can adapt to the development trend of networked incubation platforms to efficiently empower startups through resource linkage in the inner network of multiple closely linked incubation sites (Li, M.Y., Yang, D.L., Hu, X. & Zhang, J.S., 2022) [66] or even evolve a new digital entrepreneurial ecosystem in a specific physical or network space through organizational model changes such as meta-organization (Du, W., et al., 2018) [32]. Accordingly, the following hypothesis was proposed.

Hypothesis H_2: Incubators' entrepreneurial service support plays a mediating role between the development of the digital economy and the performance of incubated firms, and resource support such as capital, technology, talent, and knowledge is an important channel through which the digital economy promotes the performance of firms.

3. Data, Variables and Methodology

3.1. Sample and Data

This paper selected a large sample of business incubators, their incubatees from the Torch High Technology Industry Development Center of the Ministry of Science & Technology of China (THTIDC, MSTC) from 2015 to 2019, as well as data from the China City Statistical Yearbook. THTIDC is an independent legal entity affiliated with the Ministry of Science and Technology of China, which regularly collects statistical data on various types of innovation and entrepreneurship platforms at all levels every year. The statistical scope of data covers almost all business incubators in all prefecture levels and above cities in China, making it the most comprehensive and authoritative source of microdata on incubators in China. The China City Statistical Yearbook is regularly collected and published by the National Bureau of Statistics of China, including indicators on various aspects of socio-economic development and urban construction, covering the annual data of more than 600 established cities (including prefecture-level and above cities and county-level cities). The above data are all from the official statistics of the Chinese government, with strong reliability and representativeness.

The sample data were processed as follows: the data of enterprises with seriously missing important data were deleted. The main continuous variables of incubators and incubatees were subjected to between 1% and 99% tail shrinkage to eliminate the effects of outliers. Matching incubator and enterprise data with city data according to city codes constructed unbalanced panel data. This resulted in the 305 prefecture-level and above cities, 6400 incubators, and 471,686 incubated enterprises for 5 consecutive years, with a total of 973,048 observations. Due to the impact of the new coronavirus pneumonia epidemic after 2020, data before 2019 were selected for this paper.

3.2. Variables

Dependent variable: the performance of incubatees (*Perf*), measured by *logIncome*, produces the value of the total revenue. Considering that a single indicator cannot reflect the whole picture of enterprise performance, this paper selected eight indicators reflecting enterprise growth from the three perspectives of financial performance, employment contribution, and innovation output, including the log of total revenue, log of net profit, the number of employees, the number of college students employed, the number of doctoral and foreign student employees, the number of intellectual property applications, the number of licenses and the cumulative number of effective intellectual property rights in the current year. The data of the above eight indicators were standardized, and dimensionality was reduced using principal component analysis to calculate the enterprise growth index (*IFPI*), which was used for robustness testing. Meanwhile, the *logProfit of* net profit (*logProfit*) was used as a supplementary test.

Explanatory variable: the level of urban digital economy development (*DEI*). Referring to the idea of Zhao, T., et al. (2020) [4] to construct the indicator system, principal component analysis was used to calculate the comprehensive indicators. Six specific indicators were selected: the internet penetration rate (number of internet users per 100 people); the number of internet-related employees (information, transmission, computer services, and software industry employees/total number of employees at the end of the year); the number of mobile internet users (cell phone users per 100 people); internet-related output (telecommunication business per capita = total telecommunication business/total population at the end of the year); and the digital economy innovation and entrepreneurship index (*IRIEDEC*), using city indicators measured by the Enterprise Big Data Research Center of Peking University (Dai, R.C., Wang, A.Z. & Chen, B.K., 2022) [67]; and Digital Inclusive Finance Development Index (*DFII)*, using city indicators compiled by the Digital Finance Research Center of Peking University (Guo, F., Wang, J.Y., Wang, F., Kong, T., Zhang, X. & Cheng, Z.Y., 2020) [68]. The *DEI* indicators and the three weighted sub-indicators (digital infrastructure *F1DEI*, digital innovation, entrepreneurship *F2DEI*, and digital workforce *F3DEI*) for each city were calculated by principal component analysis. Meanwhile, two new indicators (*DEIEN* and *DEICV*) for robustness testing were obtained by remeasurement using the entropy value method and coefficient of variation method.

Mediator variables: Two indicators were selected for each of the incubator-level supports in terms of capital, technology, talent, and intelligence; FRS was selected for the number of enterprises invested by incubation funds in the year and the number of enterprises receiving venture or angel investment in this year; TRS was selected for the logarithm and total revenue of public technology service platforms and the logarithm of the average R&D investment of incubated enterprises (reflecting the degree of incentive of incubators for enterprise R&D); HRS was selected for the number of incubated enterprises receiving fresh university graduates and the number of employees of incubated enterprises. HRS was selected for the total number of fresh college graduates absorbed, the total number of employees in the incubated enterprises, and KRS was selected for the number of times entrepreneurship education and training closely related to entrepreneurship counseling and the number of enterprises docked by entrepreneurship mentors.

Control variables: since incubators must be combined with factors at the firm and other levels have an impact on firm development (Mas-Verdú, Ribeiro-Soriano, & Roig-Tierno, 2015) [69], the three control variables at the firm, including the incubator and city levels, are simultaneously considered here. The 10 variables at the firm level include firm age, length of incubation, registered capital, whether it is a high-technology firm, whether it contacts a business mentor, the number of employees, employee structure, the amount of angel or venture capital received, R&D investment, and patent output. The 9 variables at the incubator level include incubator age, the number of employees, office space, incubator revenue, market-based investment share, revenue structure (nonproperty revenue share), government funding, the number of incubatees, and the number of business mentors in place. Four variables at the city level include the level of economic development (logarithm of GDP per capita), the level of advanced industrial structure (the ratio of value added of the three industries to the second industry), the degree of fiscal decentralization (the ratio of fiscal budget revenue to expenditure), and the level of financial development (the balance of institutional deposits and loans divided by GDP). The control variables at the incubator and city levels were chosen as needed. See Table 1 for details.

Characteristic variables: Three dummy variables from each of the incubator and firm levels were selected for heterogeneity analysis. Incubator level: type of incubator (*sType*: 1—professional, 0—integrated), *nature of* ownership (*sNature*: 1—state, 0—private), level (*sNational*: 1—national, 0—nonnational). Enterprise level: whether the main person in charge is a university student entrepreneur (*entrepreneur*: 1—yes, 0—no), whether he or she is a *serialEntrep*, and whether the enterprise belongs to the electronic information field (*isEIT*). (The incubatees belong to a total of 13 technology categories, including electronic information, advanced manufacturing, aerospace, modern transportation, biomedical and medical devices, new materials, new energy and energy conservation, environmental protection, earth, space, and ocean, nuclear application technology, modern agriculture, cultural and creative, and others).

Table 1. Main variable definition.

Variable Category	Variable Name	Variable Symbols	Definition and Measurement of Variables
Dependent variable (*Perf*)	Corporate Performance	*logIncome*	Total enterprise revenue (in natural logarithm)
		logProfit	Enterprise net profit (taking natural logarithm)
		IFPI	Firm growth length (for robustness testing)
Explanatory variables (*DEI*)	City Digital Economy Development Level	*DEI*	Referring to the index system of Zhao, T., et al. (2020) [4], principal component analysis was used to calculate
		DEICV	
		DEIEN	The same indicator system as above, weighted by the coefficient of variation method
			The same indicator system as above, weighted by the entropy method
Mediator variables (*M*)	Financial Resource Support (FRS)	*sFirmNumByIFund*	FRS1: Number of incubatees that received investment from the incubation fund in the current year
		sAFirmNumByAnnVC	FRS2: Number of incubatees that received venture or angel investment in the current year
	Technical Resource Support (TRS)	*logsTechPlatIncome*	TRS1: Logarithm of total revenue of public technology service platforms
		logsFirmsPerRD	TRS2: Logarithm of average R&D investment of incubatees
	Human Resources Support (HRS)	*sFEmployeesGraduates*	HRS1: Number of recent college graduates absorbed
		sFirmEmployees	HRS2: Total number of employees in the incubatees
	Knowledge Resource Support (KRS)	*sFirmsTraineesNum*	KRS1: Incubatees' education and training attendance
		sMentor2Firms	KRS2: Number of business mentors to companies
Control variables (*CV*)	Company Age	*firmAge*	Current year minus year of incorporation
	Length of incubation	*fIncubatedAge*	The number of years a company can be in the incubator
	Registered Capital	*logRegCapital*	Logarithmic value of registered capital of enterprises
	Technology Category	*hightech*	Whether it is a high technology enterprise
	Business Mentor	*hasMentors*	Whether to contact a business mentor
	Number of employees	*employees*	Number of employees owned by the company
	Employee Structure	*StaffStructure*	Doctoral and study abroad staff Share of employees
	Get Invested	*logAngelInvest*	Logarithmic value of angel or venture capital investment received
	R&D investment	*logRD*	Logarithmic value of R&D expenses
	Innovation Output	*getIPAPP*	Whether to apply for a patent in that year

Note: Incubator, city-level control variables, and characteristic variables are not listed. *logIncome* and *DEI* are used in formal regressions.

3.3. Regression Model

To test the relationship between the urban digital economy development and the performance of incubatees, a benchmark regression model was set.

$$Perf_{i,t} = \alpha_0 + \alpha_1 DEI_{j,t} + \sum_{\tau=1}^{m} \beta_\tau FCV_{\tau,i,t} + \sum_{\tau=1}^{n} \gamma_\tau ICV_{\tau,k,t} + \sum \eta + \varepsilon_{i,t} \quad (1)$$

$Perf_{i,t}$ denotes the performance of incubatee i in period t. *It* can be taken as *logIncome*, *logProfit*, or *IFPI*. $DEI_{j,t}$ is the level of digital economy development in city j where the firm is located. $FCV_{i,t}$ and $ICV_{k,t}$ denote the control variables at the firm and incubator levels, respectively. $\sum \eta$ denote dummy variables controlling for year, industry (technology field to which the firm belongs), and city fixed effects, and ε is a random error term.

To test the mediating role of incubator entrepreneurial service support, a stepwise regression method was used to set up a mediating effect model.

$$M_{k,t} = \alpha_0 + \alpha_1 DEI_{j,t} + \sum_{\tau=1}^{m} \beta_\tau FCV_{\tau,i,t} + \sum_{\tau=1}^{n} \gamma_\tau ICV_{\tau,k,t} + \sum \eta + \varepsilon_{i,t} \quad (2)$$

$$Perf_{i,t} = \alpha_0 + \alpha_1 DEI_{j,t} + M_{k,t} + \sum_{\tau=1}^{m} \beta_\tau FCV_{\tau,i,t} + \sum_{\tau=1}^{n} \gamma_\tau ICV_{\tau,k,t} + \sum \eta + \varepsilon_{i,t} \quad (3)$$

$M_{k,t}$ denotes the mediator variable at the incubator level, i.e., the proxy variable characterizing FRS, TRS, HRS, and KRS. The remaining variables are as above. Referring to the stepwise method of Baron & Kenny (1986) [70] and drawing on the test of Wen, Z.L. & Ye, B.J., (2014) [71], the *DEI was* taken and regressed on the mediator variables based on the baseline regression, and then the *DEI* and the mediator variables were regressed together on *Perf*, and if both were significant, the mediating effect held; if at least one was not significant, further tests were conducted.

To test the possible influence of heterogeneous characteristics of incubators and incubatees, a test model including the cross-product term was introduced.

$$Perf_{i,t} = \alpha_0 + \alpha_1 DEI_{j,t} + \alpha_2 MV_t + \alpha_3 DEI_{j,t} \times MV_t + \sum_{\tau=1}^{m} \beta_\tau FCV_{\tau,i,t} + \sum_{\tau=1}^{n} \gamma_\tau ICV_{\tau,k,t} + \sum \eta + \varepsilon_{i,t} \quad (4)$$

MV_t denotes feature variables, which are taken to be *sType*, *sNature*, *sNational*, *entrepreneur*, *serialEntrep*, and *EIT*. $DEI_{j,t} \times MV_t$ denote the interaction term. The *DEI was* centered before introducing the interaction term. Since whether the control variables are centered or does not affect the regression analysis, no centering was conducted for the control variables. The coefficient of the interaction term was α_3. If significant, it indicated a difference in the correlation between the digital economy and incubatees' performance, and if not significant, there was no difference.

Each model was regressed using ordinary least squares (OLS). Since the originally hypothesized correlations could have individual fixed effects, the above regressions were chosen as fixed effects models. The dependent and core explanatory variables were benchmarked with *logIncome* and *DEI*, respectively, and the remaining indicators were used as robustness tests. To test the robustness of the benchmark regression results, various methods such as two-way fixed effect models were used (controlling for time and individual firm fixed effects), replacing the core variable indicator explanations, lagging the core explanatory variables, subsample regressions, and the instrumental variables method, which were also used to further overcome the endogeneity problem.

4. Empirical Results and Analysis

4.1. Descriptive Statistical Analysis

The descriptive statistics of the sample data are shown in Table 2. The urban digital economy development index measured in this paper is more ideal, and the *DEI* measured by the principal component analysis method takes values ranging from 0.221 to 7.101 with a mean value of 2.447, and the statistical characteristics of *DEICV* and *DEIEN* measured by the coefficient of variation method and the entropy value method were relatively close. The multicollinearity test showed that when the baseline regression was performed with *logIncome* as the dependent variable, the mean value of the variance inflation factor (Mean VIF) of the independent variables was 1.38, the VIF of the respective variables was less than 2 and much less than 10, and there was no serious multicollinearity problem between the explanatory and control variables. The Hausman et al. tests for the mixed regression, random effects, and fixed effects models indicate that the fixed effects model was the more appropriate choice.

4.2. Benchmark Regression

Table 3 reports the regression results. Columns (1), (3), and (5) the control for the year, industry, and city fixed effects, and Columns (2), (4), and (6) control for both year and individual firm fixed effects. In all the models, *DEI was* significantly and positively correlated with the dependent variable *logIncome*. Of these, Column (3) produced the regression result for the baseline model (1) described previously (the remaining columns are used for comparison and robustness testing), and the correlation coefficient for DEI is 0.074, which is strongly significant at the 1% level. There is a positive impact of urban digital economy development on the income level of incubatees with or without the introduction of incubator and city-level control variables. Hypothesis H_1 was initially tested.

Table 2. Descriptive statistics of the main variables.

Variables	Number of Samples	Average Value	Standard Deviation	Minimum Value	Maximum Value
logIncome	972,999	5.614	3.358	0.000	11.381
IFPI	863,808	0.900	0.590	0.265	5.201
logProfit	864,057	3.337	2.937	0.000	9.295
DEI	965,902	2.447	1.243	0.221	7.101
DEICV	965,902	0.304	0.107	0.085	0.646
DEIEN	965,902	0.408	0.106	0.130	0.683
sFirmNumByIFund	973,048	4.677	9.570	0	59
sAFirmNumByAnnVC	973,048	4.433	7.208	0	42
logsTechPlatIncome	973,048	2.735	3.382	0.000	12.356
logsFirmsPerRD	973,048	4.275	2.226	0.000	7.865
sFEmployeesGraduates	973,048	115.232	148.909	0	820
sFirmEmployees	973,048	1124.349	1076.710	44	6008
sFirmsTraineesNum	973,048	1169.090	1592.851	0	10,031
sMentor2Firms	973,048	48.431	47.962	0	268
firmAge	935,441	3.042	3.198	0	16
fIncubatedAge	935,441	1.897	2.006	0	11
logRegCapital	973,047	6.591	2.750	0.000	11.002
hightech	972,518	0.096	0.294	0	1
hasMentors	972,433	0.597	0.490	0	1
employees	973,047	16.526	21.426	1	144
StaffStructure	973,047	0.029	0.086	0.000	0.500
logAngelInvest	973,048	0.365	1.564	0.000	8.594
logRD	973,022	2.334	2.877	0.000	8.810
getIPAPP	973,048	0.250	0.433	0	1

Note: Only control variables at the incubatee level are reported.

4.3. Robustness Tests

To test the robustness of the regression results and to overcome as much as possible the endogeneity problems caused by omitted variables, measurement error, reverse causality, and sample selection bias, various approaches were taken in this paper. First, a more reasonable causal inference was made using the instrumental variables approach. Second, some other conventional methods were applied for further testing.

Regional digital economy development, as a macro factor, usually does not become an endogenous variable affecting the business performance of micro firms. However, for rigorous consideration, this paper still considers the city digital economy development index *DEI* as an endogenous variable and draws on the widely accepted thinking method (Zhao, T., et al., 2020; Huang, Q.H., Yu, Y.Z. & Zhang, S.L., 2019) [4,72] to construct an instrumental variable using historical postal and telecommunication data (number of post offices or fixed telephones) for each city in 1984 and then conduct TSLS (two-stage least squares) regression. The development of the digital economy has benefited from the popularity of the internet, which started with landline dial-up (PSTN) and gradually developed through ISDN and ADSL to fiber optic broadband and mobile networks. Early fixed-line telephones were laid by post offices, and thus, the historical distribution of post offices and fixed-line telephone usage influenced the later level of internet access, as well as the acceptance and usage habits of local residents for information and communication technology (ICT) and were reflected in the construction of the information infrastructure and even the development of the digital economy. However, with the innovation and iteration of ICT, traditional communication methods such as post office (telegraph) and fixed telephone gradually withdrew from the stage and were replaced by cell phones and smartphones. The impact on the digital economy tends to disappear, and it has become difficult to influence the business performance of microenterprises. Therefore, historical postal and telecommunication service data were selected to construct instrumental variables that satisfy the requirements of relevance and exclusivity. To convert cross-sectional data into indicators suitable for use in panel data, the interaction term was constructed using the number of post offices per 10,000 people in each city in 1984 (related to individual changes) and the amount of national ICT service industry fixed asset investments in the previous year (related to time changes) as endogenous variables, referring to the treatment of Huang, Q.H., et al. (2019) [72] and Nunn, N. & Qian, N., (2014) [73] for the instrumental variable of *DEI* (*IVDEI*).

Table 3. Benchmark regression results.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
DEI	0.052 *** (4.73)	0.044 *** (3.35)	0.074 *** (6.31)	0.075 *** (5.14)	0.057 *** (4.76)	0.060 *** (4.06)
firmAge	0.148 *** (112.26)	0.001 (0.30)	0.139 *** (100.39)	0.004 (0.74)	0.139 *** (100.38)	0.003 (0.69)
fIncubatedAge	0.127 *** (62.03)	0.100 *** (23.40)	0.127 *** (59.46)	0.103 *** (22.69)	0.127 *** (59.42)	0.103 *** (22.63)
logRegCapital	0.105 *** (82.13)	0.104 *** (49.55)	0.104 *** (75.34)	0.103 *** (44.66)	0.104 *** (75.35)	0.102 *** (44.62)
hightech	0.072 *** (7.05)	0.024 (1.52)	0.085 *** (8.06)	0.038 ** (2.25)	0.084 *** (7.99)	0.035 ** (2.04)
hasMentors	0.203 *** (33.28)	0.194 *** (20.32)	0.219 *** (33.55)	0.181 *** (17.78)	0.219 *** (33.61)	0.181 *** (17.79)
employees	0.029 *** (165.50)	0.025 *** (66.42)	0.027 *** (153.08)	0.024 *** (62.20)	0.027 *** (153.16)	0.024 *** (62.30)
StaffStructure	−3.319 *** (−91.04)	−0.420 *** (−6.21)	−3.269 *** (−84.45)	−0.446 *** (−6.15)	−3.262 *** (−84.29)	−0.443 *** (−6.12)
logAngelInvest	0.002 (0.88)	0.028 *** (11.07)	0.004 ** (2.35)	0.025 *** (9.83)	0.004 ** (2.29)	0.025 *** (9.80)
logRD	0.350 *** (302.49)	0.312 *** (160.74)	0.343 *** (281.74)	0.307 *** (149.81)	0.343 *** (281.52)	0.307 *** (149.69)
getIPAPP	0.559 *** (86.06)	0.489 *** (54.17)	0.555 *** (82.56)	0.481 *** (51.01)	0.555 *** (82.61)	0.482 *** (51.09)
Constant	2.104 *** (41.13)	2.838 *** (84.06)	0.397 *** (5.63)	1.600 *** (10.23)	−7.827 *** (−12.03)	−2.942 *** (−4.14)
Incubator CVs	NO	NO	YES	YES	YES	YES
City CVs	NO	NO	NO	NO	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	NO	YES	NO	YES	NO
City FE	YES	NO	YES	NO	YES	NO
Firm FE	NO	YES	NO	YES	NO	YES
N	927,118	927,117	826,753	826,752	826,753	826,752
Adjusted R^2	0.346	0.158	0.354	0.163	0.354	0.164

Note: ** $p < 0.05$, *** $p < 0.01$. The values in parentheses below the coefficients are the t-values under the robust standard errors of clustering. Columns (2), (4), and (6) report within R^2. Incubator CVs and City CVs indicate whether incubator, city-level control variables are introduced. FE indicates whether the corresponding individual fixed effects are controlled for.

From the correlation of the control variables, it can be found that the length of incubation, enterprise size (registered capital), and the number of employees, whether it be a high-tech enterprise, and whether it be contacted with mentors all had a positive impact on revenue; the correlation coefficient of R&D innovation (R&D investment and patent output) was larger, and the positive impact was more obvious. The correlation coefficient of obtaining angel or venture capital was smaller but significantly and positively correlated; the staff structure and revenue level were strongly negatively correlated, indicating that recruiting Ph.D. and study abroad staff may not help revenue capacity.

The TSLS estimation results in Columns (1) and (2) of Table 4 shows that the unidentified test Kleibergen–Paap (K-P) rk LM statistic was strongly significant (62.41 ***), the weak identification test K-P F statistic (62.34 ***) was greater than the critical value at the Stock-Yogo 10% level (16.38), and there were no unidentified and weak identification problems. The number of instrumental variables was equal to the number of endogenous variables, and the model was exactly identified. The instrumental variables were valid and significantly positively correlated in the second stage. Controlling for the endogeneity problem, the original Hypothesis H_1 still held.

Table 4. Robustness testing—instrumental variables approach vs. other methods.

Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Perf = (*DEI* =)	*DEI* (*IVDEI*)	*logIncome* (*DEI*)	*IFPI* (*DEI*)	*logProfit* (*DEI*)	*logProfit* (*L1DEI*)	*logProfit* (*F1DEI*)	*logProfit* (*F2DEI*)	*logProfit* (*F3DEI*)	*logIncome* (*DEICV*)	*logIncome* (*DEIEN*)
DEI	0.235 *** (7.90)	4.000 *** (5.19)	0.004 * (1.91)	−0.032 *** (−2.68)	0.049 *** (3.48)	−0.074 *** (−6.02)	0.674 *** (7.13)	0.269 *** (7.26)	1.081 *** (7.42)	1.786 *** (9.83)
Constant	4.270 *** (559.54)	−16.640 *** (−5.00)	0.289 *** (24.11)	0.212 *** (3.17)	−0.132 * (−1.79)	0.191 *** (4.01)	−0.055 (−1.17)	−0.291 *** (−4.33)	0.209 ** (2.49)	−0.249 ** (−2.26)
CVs	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
FEs	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	799,946	799,946	731,586	731,815	731,815	731,815	731,815	731,815	826,753	826,753
Adjusted R^2		0.267	0.585	0.345	0.345	0.345	0.345	0.345	0.354	0.354

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. CVs denote the introduction of firm- and incubator-level control variables, FEs denote control for year, industry, and city fixed effects, and no control variables are reported, as below. Columns (1) and (2) show the estimation results of the instrumental variable method TSLS with the under identification test (K-P LM Stat.) equal to 62.41 *** and weak identification test (K-P F Stat.) equal to 62.34 *** and Stock-Yogo test 10%. The critical value for the level is 16.38. Columns (3) to (10) show the results of the test after replacing the dependent or independent variable indicator explanations.

Other tests were equally robust (only partial results are reported in Table 4), and Hypothesis H_1 was fully tested.

A fixed effects model was used. As shown in Table 3, *DEI* was significantly and positively correlated with total firm revenue in all columns, regardless of controlling for the year, industry, and city fixed effects or year and individual firm fixed effects.

Adding or subtracting control variables. The original Hypothesis H_1 holds when the baseline Model (1) introduces some or all of the firm-, incubator-, and city-level control variables or no control variables (see Table 3).

The dependent variable indicator was replaced. The original hypothesis is still supported by replacing the dependent variable with the length of incubated firms (*IFPI*) or the value of the log profit of firms (*logProfit*). Columns (3) to (8) of Table 4 show that *DEI is* significantly positively correlated with *IFPI*, and, although it is negatively correlated with *logProfit*, both *DEI* with a lag of 1 period (*L1DEI*) and the sub-indicators of *DEI* (*F2DEI*: Digital Innovation Entrepreneurship, *F3DEI*: Digital Workforce) are positively correlated with *logProfit*, and digital infrastructure (*F1DEI*) is negatively correlated with it. A possible reason for this is that startups are generally less profitable, and there is a lag effect and weakness in the positive impact of the digital economy on net profit.

The indicators of core explanatory variables were replaced. Replacing the explanatory variables *DEI* with *DEICV* and *DEIEN* calculated by the coefficient of variation method and the entropy value method, as well as the three sub-indicators of *DEI* (*F1DEI*, *F2DEI*, *F3DEI*) means that the results of the regression on *logIncome* are significantly positively correlated, and the correlation coefficients of *DEICV* and *DEIEN are* also larger (Columns (9) and (10) of Table 4).

The explanatory variables were treated with lags. The *DEI* with lags from 1 to 4 periods was introduced into the baseline Model (1) for regression, and the results were also significantly positively correlated. There is a lagged effect of the digital economy on the performance of incubatees, which was most pronounced in the current period (correlation coefficient 0.074) and continues to work for at least four periods (correlation coefficient between 0.050 and 0.062).

Subsample regression was used. Subsample 1: data from 2016 to 2019; subsample 2: enterprises whose principals are noncontinuous entrepreneurs; subsample 3: incubators in national high-tech zones; subsample 4: enterprises in the field of electronic information only; subsample 5: enterprises with at least 2 years of incubation; Subsample 6: companies with at least three consecutive years of data availability. The results show that *DEI is* significantly and positively correlated with the total revenue, but the magnitude of the correlation coefficient varies (between 0.042 and 0.125), with Subsample 5 being the largest and Subsample 3 the smallest. Except for Subsamples 3 and 4, the correlation coefficients of all the subsamples were larger than that of the total sample. The stable incubation length and first-time start-ups were very critical, and it seemed to make little difference whether the incubator enjoyed policy support from the national high-tech zone or not, and start-ups in the electronic information field may have been weaker than others in sharing the digital dividend instead.

4.4. Heterogeneity Analysis

There may be heterogeneity in the impact of the digital economy of the entrepreneurships, with incubators and incubatees differing in the extent to which they are affected by different characteristics. Some clues can be found in the subsample regressions. The degree of specialization, nature of ownership, the scale of operation, incubation experience, and level of development of the region and industry in which the incubator is located may have a heterogeneous impact. In emerging industries spawned by the digital economy, the identity and behavioral characteristics of founders, such as age, gender, educational and knowledge structure, and entrepreneurial experience, among other factors, had a strong influence on firm development (Fayolle & Gailly, 2015; Zuzul & Tripsas, 2020) [62,74].

To test the impact of this heterogeneity, the following regression analysis was performed on six characteristic variables (see variable definitions) at the incubator and firm levels according to the predefined Model (4). The determination was made by the following: if the coefficient of the interaction term *DEIXMV* between the independent variable *DEI* and the characteristic variable *MV* (taking the value 1 or 0) was significantly positive, the group with *MV*, which took the value 1, was affected to a greater extent by the digital economy; if the coefficient was significantly negative, the group with *MV* taking the value 0 was affected to a greater extent; if it is not significant, there is no difference between the two groups. The coefficients of the interaction terms in all columns of Table 5 are strongly significant, indicating that there are indeed differences in the impact of the digital economy on the revenues of incubated firms.

Table 5. Heterogeneity test results.

Models	(1)	(2)	(3)	(4)	(5)	(6)
Characteristic variable *MV*	*sType*	*sNature*	*sNational*	*entrepreneur*	*serialEntrep*	*isEIT*
DEI	0.087 *** (7.28)	0.106 *** (8.08)	0.095 *** (7.79)	0.070 *** (5.96)	0.079 *** (6.67)	0.096 *** (7.95)
MV	−0.057 *** (−7.39)	−0.282 *** (−26.47)	0.159 *** (17.99)	0.069 *** (8.62)	0.028 *** (4.23)	0.200 *** (3.93)
DEIXMV	−0.023 *** (−3.95)	−0.043 *** (−6.50)	−0.035 *** (−6.62)	0.029 *** (4.13)	−0.012 ** (−2.35)	−0.038 *** (−7.60)
Constant	0.594 *** (11.07)	0.806 *** (14.91)	0.718 *** (13.26)	0.557 *** (10.41)	0.570 *** (10.65)	0.380 *** (5.24)
CVs	YES	YES	YES	YES	YES	YES
FEs	YES	YES	YES	YES	YES	YES
N	824,368	826,753	826,691	826,753	825,691	826,753
Adjusted R^2	0.354	0.355	0.354	0.354	0.354	0.354

Note: ** $p < 0.05$, *** $p < 0.01$. *MV* denotes the feature variable, and *DEIXMV* denotes the interaction term of *DEI* and *MV*.

Columns (1), (2), and (3) show the test results for the three characteristic variables at the incubator level. The coefficients of the interaction terms in all three columns are significantly negative. In terms of the degree of impact of the digital economy on firm revenue, the integrated incubators were larger than specialized incubators, private incubators were larger than state-run incubators, and nonnational incubators were larger than national incubators. Incubatees in integrated, private, or nonnational incubators are more likely to be stimulated by the digital economy and more likely to benefit from the development of the digital economy. Columns (4), (5), and (6) show the test results for the three firm-level characteristic variables. The coefficient of the interaction term in Column (4) was significantly positive, and the coefficient of the interaction term in Columns (5) and (6) was significantly negative. If the main person in charge of the incubated enterprise was a college student entrepreneur or a noncontinuous entrepreneur and the technology field of the enterprise did not belong to the electronic information field, the revenue capacity of the enterprise was more strongly influenced by the positive impact of the digital economy.

From the distribution of sample enterprises, enterprises in state-run incubators account for the majority and almost half of the enterprises in the field of electronic information, while both types of enterprises are weakly affected by the digital economy. Therefore, state-run incubators and their incubated enterprises and electronic information enterprises should be the focus of business incubation support, but attention should also be given to guiding these enterprises to rational entrepreneurship and healthy development while encouraging private incubators and start-ups in other technology fields to accelerate their development.

5. Analysis of Impact Mechanism

5.1. Test Method of the Mediating Effect

Hypothesis H_2 was tested using stepwise regression according to the baseline Model (1) and the mediating effect Model (2), (3) (Baron & Kenny, 1986; Zhonglin Wen & Baojuan Ye, 2014). The specific test logic and procedure were as follows.

For illustration, the model (1), (2), (3) was simplified here as Equations (5)–(7) in turn, and e_1, e_2, and e_3 as the regression residuals. The significance of the coefficients c, a, b, and c' could be determined by stepwise testing considering whether the independent variable X had an effect on the dependent variable Y through the mediator variable M. (1) To test whether coefficient c was significant, the baseline regression verified that *c was* significantly positive. (2) To test the coefficients a and b, if both were significant, it meant that the indirect effect was significant; if at least one was insignificant, further testing was required using the Sobel method or bootstrap method. In this paper, the test result revealed that both a and b were significant. (3) If the indirect effect was significant, the tested coefficient was c'. If c' was significant, the direct effect was significant, and there could be multiple mediators; otherwise, the direct effect was not significant, and there was only a mediating effect. (4) To compare the signs of ab and c' and report the effect size, if they have the same sign, a partial mediating effect was reported ab/c; if the positive and negative signs were different, the masking effect was reported $|ab/c'|$. In this paper, the indirect effect ab was the mediating effect, and its sum, along with the direct effect c', is the total effect c (Equation (8)).

$$Y = cX + e_1 \tag{5}$$

$$M = aX + e_2 \tag{6}$$

$$Y = c'X + bM + e_3 \tag{7}$$

$$c = c' + ab \tag{8}$$

5.2. Test Results of the Mediating Effect

Following these ideas, this paper focuses on four intermediary channels (FRS, TRS, HRS, and KRS) at the incubator level. The test results in Tables 6 and 7 show that all four intermediary channels held, and Hypothesis H_2 was tested. All mediator variables played a positive mediating role, except for the masking effect (negative mediation) of the average R&D investment of the firm in the TRS. Taking FRS as an example, when the mediator variable *M* is the number of enterprises invested in by the incubation fund and the number of enterprises receiving angel or venture capital in that year, the coefficients a, b and c' are significantly positive, *ab*, and c' have the same sign, and the partial mediation effect *ab/c is* equal to 0.1096 and 0.0215, respectively. The partial mediation effect indicates that the digital economy can be supported by the incubator's capital, technology, talent, knowledge, and other resource support, which positively affects the revenue capacity of incubatees. The masking effect, on the other hand, implies that the digital economy, while prompting incubators to strengthen their resource support (e.g., TRS), is limited by other factors and does not lead to an increase in the revenue level of incubatees.

Table 6. Mechanism of action test 1: Financial and technical resource support from incubators (FRS & TRS).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Y =	*M*	*logIncome*	*M*	*logIncome*	*M*	*logIncome*	*M*	*logIncome*
M =	FRS1: *sFirmNumByIFund*		FRS2: *sAFirmNumByAnnVC*		TRS1: *logsTechPlatIncome*		TRS2: *logsFirmsPerRD*	
X = *DEI*	1.014 ***	0.066 ***	0.227 ***	0.073 ***	0.102 ***	0.072 ***	0.123 ***	0.081 ***
	(21.43)	(5.61)	(8.11)	(6.18)	(8.15)	(6.10)	(18.29)	(6.87)
M		0.008 ***		0.007 ***		0.026 ***		−0.052 ***
		(23.39)		(13.61)		(25.03)		(−24.64)
Mediating effect	Partial mediating effect *ab/c* = 0.1096		Partial mediating effect *ab/c* = 0.0215		Partial mediating effect *ab/c* = 0.0358		Significant masking effect $\vert ab/c' \vert = 0.0790$	
CVs	YES	YES	YES	YES	YES	YES	YES	YES
FEs	YES	YES	YES	YES	YES	YES	YES	YES
N	826,802	826,753	826,802	826,753	826,802	826,753	826,802	826,753
Adjusted R^2	0.369	0.354	0.475	0.354	0.272	0.355	0.459	0.355

Note: *** $p < 0.01$. Control variables and constant terms are not listed. Partial mediating effect *ab/c* indicates the proportion of mediating effect to total effects, and masking effects $\vert ab/c' \vert$ indicates the proportion of indirect effects to the absolute value of the ratio of direct effects. The correlation coefficient c between *DEI* and *logIncome* in the baseline regression Model (1) is equal to 0.074.

Table 7. Mechanism of action test 2: Incubator human and knowledge resource support (HRS & KRS).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Y =	*M*	*logIncome*	*M*	*logIncome*	*M*	*logIncome*	*M*	*logIncome*
M =	HRS1: *sFEmployeesGraduates*		HRS2: *sFirmEmployees*		KRS1: *sFirmsTraineesNum*		KRS2: *sMentor2Firms*	
X = *DEI*	6.392 ***	0.066 ***	20.214 ***	0.070 ***	134.391 ***	0.072 ***	5.355 ***	0.066 ***
	(12.02)	(5.63)	(6.11)	(5.95)	(20.36)	(6.13)	(31.29)	(5.58)
M		0.001 ***		0.0002 ***		1.59×10^{-5} ***		0.002 ***
		(47.70)		(39.22)		(7.34)		(18.53)
Mediating effect	Partial mediating effect *ab/c* = 0.0864		Partial mediating effect *ab/c* = 0.0583		Partial mediating effect *ab/c* = 0.0289		Partial mediating effect *ab/c* = 0.1447	
CVs	YES	YES	YES	YES	YES	YES	YES	YES
FEs	YES	YES	YES	YES	YES	YES	YES	YES
N	826,802	826,753	826,802	826,753	826,802	826,753	826,802	826,753
Adjusted R^2	0.510	0.356	0.743	0.355	0.343	0.354	0.514	0.354

Note: *** $p < 0.01$.

In the case of active innovation and entrepreneurship in the digital economy, the mediating effect of four types of resource support varies, but all are indispensable. Financial resource support: internal incubation fund investment and external angel or venture capital investment are the main financing channels provided by incubators for incubated enterprises. The higher the level of development of the digital economy, the better the investment and financing environment for innovation and entrepreneurship, and the timelier and more accurate the incubator can be for helping enterprises raise funds and relieve capital pressure. Technical resource support: investing in and operating public technology service platforms and guiding and stimulating enterprises' R&D and innovation are important ways for incubators to provide technical services to enterprises. Although the digital economy has increased the overall intensity of R&D investment in incubated enterprises, this positive incentive may be limited by the inadequacy of the innovation output and results in a transformation link and has not increased the income level of enterprises. The positive intermediary role of incubator public technology services was likely to be offset by the masking effect in terms of enterprise R&D innovation. Human resource support: The digital economy brings better employment, and entrepreneurship and a talent environment to the entire incubation industry, facilitating incubators to attract more and better-quality talent to join the business. By absorbing more recent college graduates and helping companies recruit more high-quality talent, incubators can provide companies with a constant supply of human resources, creating a talent clustering effect. Knowledge resource support: Providing knowledge services through entrepreneurship coaching is a top priority, for example, connecting and matching companies with business mentors and providing entrepreneurship education or training programs. The digital economy makes entrepreneurship full of unknowns and uncertainties, and entrepreneurs obtain learning opportunities and knowledge services from incubators, which helps avoid entrepreneurial risks and increases the possibility of success.

In terms of the magnitude of the mediating effect of each indicator, the number of enterprises contacted by business mentors (KRS2) and the investment of incubation funds (FRS1) had the largest mediating effect (0.1447 and 0.1096), followed by HRS1, HRS2, and TRS2, while the remaining indicators had smaller mediating effects. Incubators should prioritize sustained efforts in the areas of entrepreneurial mentorship, incubation fund investment, and quality talent gathering, focus on enhancing public technical service capabilities, actively guiding enterprises in R&D and innovation, and opening up angel or venture capital channels.

6. Discussion and Conclusions

In the process of China's reform, opening-up, and economic and social development, entrepreneurial activities have played an important role (Zhou, D.M., et al., 2020) [3], and mass entrepreneurship and innovation have been implemented as national policy for many years. As for the most dynamic and potential area of innovation and entrepreneurship, the digital economy is accelerating the digital transformation of innovation and entrepreneurship. When the development of the digital economy enters a new stage, incubators also usher in new challenges and opportunities. Transforming the digital economy is broken down into the effectiveness of entrepreneurship and innovation with the power of incubators, in addition to crowdsourcing spaces and other incubation platforms, which are of great significance to high-quality economic development and the majority of entrepreneurial enterprises.

6.1. Conclusion and Contributions

Existing research on the digital economy and entrepreneurship has focused on two types of issues: the impact of the digital economy on regional entrepreneurial activity at the macro level and theoretical and empirical research on digital entrepreneurship at the micro level. The importance of these two types of issues cannot be overstated, but there is a lack of research that integrates and bridges these macro and micro perspectives, especially evidence from the field of business incubation. This paper attempts to break new ground in this regard. Focusing on a combination of macro and micro perspectives, economics, and management, this study examines the direct and indirect effects of digital economy development on the performance of incubated firms based on a large sample of data from Chinese city statistics and technology business incubators. This paper presents new theoretical perspectives and empirical evidence that both discuss and validate the positive impact of the digital economy on entrepreneurship and demonstrates the important value of incubators in the digital era. This study is valuable for building a new theoretical framework on the digital economy and entrepreneurship incubation and entrepreneurial performance, expanding entrepreneurship research in the digital economy context, and the guiding digital economy and entrepreneurship policies as well as the business management of incubators and entrepreneurs.

On the one hand, urban digital economy development does help to improve the revenue capacity of startups, and the more developed the digital economy is, the better the financial performance of startups perform. After the instrumental variables approach and a series of robustness tests, this conclusion still held. This effect does not exist only in the current period but has worked over a considerable period of time (at least 4 years), i.e., it has a certain lag effect; there are also significant differences in the effect of the digital economy on the promotion of startup performances for different types of incubators and for incubates with different characteristics. These findings are in line with expectations. First, compared with other related studies, the incubation data used in this paper is a novel source of evidence that fully demonstrates the positive impact of the digital economy on micro-entrepreneurial activities. Second, the focus of this paper is on how the macro-level effectiveness of the digital economy translates into the entrepreneurial performance of micro-firms, which is a useful addition to existing research. The digital economy helps create a more dynamic and friendly entrepreneurial environment and even changes the entire entrepreneurial process and outcomes, making it easier, more efficient, and higher quality for entrepreneurs to start their businesses, thus improving business performance.

On the other hand, incubators' resource support in terms of capital, technology, human resources, knowledge, and other related services are important channels for the digital economy to promote business revenue growth. Startups generally lack sufficient resources and capabilities, and they are highly dependent on entrepreneurial service support from incubators and other external resources. The digital economy has made it easier for enterprises more eager to obtain external support. However, due to the lack of sufficient data support and reasonable evaluation indicators, most evidence in the empirical literature can only study the resource support and entrepreneurial services of incubators based on small-scale statistical data or questionnaires, which is insufficient in terms of generalizability and credibility. The large sample of data in this paper is more convincing in terms of coverage and representativeness, and the selection of indicators also takes into account all aspects of resource support that startups urgently need, confirming that incubators are still of great value in the digital economy. The study finds that although different types of incubation resources support differ in their degree of contribution, they are all indispensable for entrepreneurs. The value potential of incubators in the areas of entrepreneurial coaching and knowledge services, investment and financing, technological innovation, and talent pooling cannot be underestimated. Through sustained efforts in these areas, incubators can better help entrepreneurs share the dividends of the digital economy.

6.2. Policy Suggestions and Managerial Implications

Central and local governments should give close attention to the synergy and coordination of digital economy policies with entrepreneurship and innovation policies, guiding entrepreneurs to enhance entrepreneurship, innovation, and contractual spirit (Yu, D.H. & Wang, M.J., 2022) [5], strengthening the policy supply and policy integration of business incubation, and integrating limited policy resources to form synergistic effects. In formulating digital economy policies, the government needs to consider both the policy demand and policy orientation of entrepreneurship and innovation and take the performance of incubation platforms and the growth of startups as important development goals and assessment indicators. When implementing entrepreneurship and innovation policies, government departments at all levels should fully consider the possible impacts and priority areas of the digital economy and give more prominence to the stimulating effect of the digital economy on entrepreneurship development and the in-depth application of digital technology in the field of business incubation. In addition to using various plans and programs to strengthen macro guidance and direction, the government should also provide assistance to incubators and entrepreneurs through specific measures such as research projects, inclusive finance, tax and fee reduction, financial subsidies, talent training, and entrepreneurship education.

On the basis of making full use of policy resources, it should also strongly support the priority development of professional and private incubators, attach great importance to building the entrepreneurial service capacity of state-run incubators, and give more policy support to non-national incubators. For college students starting businesses, first-time entrepreneurs, and entrepreneurs in non-electronic information fields, the government should give targeted policy tilts.

Incubators and entrepreneurs should fully grasp the opportunities of digital economy development, build digital capabilities for digital transformation at the strategic level (Warner & Wäger, 2019) [75], and improve resource allocation efficiency and business management performance. Incubators should enhance resource aggregation and entrepreneurial service capabilities in knowledge, capital, technology, and human resources according to the needs of incubated enterprises and make entrepreneurial mentor teams, incubation fund investment, R&D innovation incentives, and quality talent pooling a top priority to help entrepreneurs find a place in innovation and industrial chains as soon as possible. Incubators should also use digital technology, digital platforms, and other means to accelerate the construction of digital dynamic capabilities and digital incubation systems and help the digital transformation of traditional entrepreneurship while strongly supporting digital entrepreneurship. Entrepreneurs should take the lead in embracing digital entrepreneurship changes from the beginning, build digital dynamic capabilities to shape competitive advantages, move into the appropriate incubator according to their own reality, maintain entrepreneurial passion and patience, and fully rely on the incubator to obtain resources; however, at the same time, they should be rational entrepreneurs and avoid blindly "chasing the wind". We should not only identify and grasp entrepreneurial opportunities in the digital industry but also see the rich scenes and vast space in the field of integration of digital technology with the real economy.

Another important insight from this paper is about the transformation and upgrading of the entrepreneurial ecosystem. By reducing coordination costs and asset specificity, the digital economy has changed the traditional entrepreneurial model and expanded the temporal and spatial dimensions of the entrepreneurial ecosystem, making its connotations and extensions more extensive. This requires that all kinds of subjects, objects, and components of the entrepreneurial ecosystem should be systematically adjusted and even reformed to jointly promote the digital transformation of the entrepreneurial ecosystem. In particular, we need to take incubators and other incubation platforms as the core link to promote the digital, platform-based, and ecological development of the business incubation industry and jointly create a digital entrepreneurial ecosystem (DEE). The whole society should focus on strengthening the network linkage and synergistic transformation of government, enterprises, universities and research institutions, financial institutions, intermediary services, etc. Leveraging the DEE, it is necessary to accelerate the convergence, integration, and sharing of entrepreneurial and innovative resources in physical and digital spaces and provide entrepreneurs with various types of resource support and online and offline entrepreneurial services.

6.3. Limitations and Scope for Future Research

Inevitably, there are some limitations and room for improvement in this study. First, the negative impact of the digital economy on entrepreneurship and the associated risks and negative aspects require attention, such as the role conflict and transition pressure of entrepreneurs in the digital ecosystem (Nambisan & Baron, 2021) [27], the crowding-out effect of the gig economy on low-quality, survival-oriented entrepreneurship (Mo, Y.Q. & Li, L.X., 2022) [40], and the ability of business founders to access resources from digital networks to obtain resources other than information (Smith, C.G. & Smith, J.B., 2021) [76]. Second, transmission mechanisms of the digital economy for entrepreneurial growth should be examined in more dimensions, such as innovation capacity and factor allocation efficiency at the city level and entrepreneurial orientation, R&D innovation, and network embeddedness at the firm level. Third, different theoretical perspectives, such as strategy, resources, capabilities, and institutions, should also be combined to explore how the digital economy promotes high-quality economic, industrial, and enterprise development through entrepreneurship incubation. Finally, whether the digital economy can strengthen the synergistic effect of entrepreneurship and innovation and bring about the integration of digital entrepreneurship and digital innovation, digital entrepreneurship and traditional entrepreneurship, and digital technology and the real economy all need to be thoroughly studied. In conclusion, there is still much room for discussion on theoretical and empirical studies on the digital economy for entrepreneurship incubation development.

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