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The Evolution Mechanism and Policy Guidance of Entrepreneurship Ecosystem in the Digital Age

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ABSTRACT
Digital technologies such as cloud computing, big data, and artificial intelligence have profoundly reshaped entrepreneurial activities, challenging the traditional entrepreneurship ecosystem that is largely based on geographical agglomeration and linear value chains. In the digital age, entrepreneurship increasingly unfolds within highly connected, platform-based, and self-organizing ecosystems that transcend physical boundaries. This paper examines the evolution mechanism of the digital entrepreneurship ecosystem from a systemic and evolutionary perspective. The main research contents of this paper include the analysis of system components, the theoretical reconstruction of entrepreneurship ecosystem in the digital age, and the insights into restructuring of policy guidance framework for ecosystem health. This work is useful to provide a theoretical reference for fostering healthy and sustainable digital entrepreneurship ecosystems.

KEYWORDS
Digital entrepreneurship ecosystem; Evolution mechanism; Platform-based innovation; Network effects; Policy guidance

1 Introduction

At the crossroads of an era where digital technologies are redrawing the map of entrepreneurship, cloud computing, big data, and artificial intelligence are not just tools for enhancing efficiency. Rather, they fundamentally transform the world in which entrepreneurship takes place, completely overturning the traditional entrepreneurial clusters centered around geographical proximity, face-to-face interactions, and linear chains. In their place emerges a new type of entrepreneurial ecosystem characterized by high fluidity, networking, and self-organization. This digital entrepreneurship ecosystem is a global network that leverages platforms as hubs, data as fuel, and algorithms as coordination mechanisms, creating value that transcends physical boundaries [1]. A Hangzhou-based startup can instantly access resources on Amazon Web Services, leverage Shenzhen's supply chain data, secure venture capital from Silicon Valley, and reach global customers through TikTok. In this vast value creation system, where speed is value, the ever-changing dynamics present a fundamental theoretical challenge and practical dilemma. For example, the traditional theory of regional economics is hard to explain how the so-called "borderless" phenomenon can be concentrated. Similarly, how can classical innovation management theory describe such rapid iterations and exponential-scale development?

More critically, the government's long-standing tools for economic prosperity on tax breaks, land grants, or targeted subsidies have now become obsolete. The harsh reality is the collapse of the entire system. In this vast, networked, decentralized ecosystem shaped by network effects, all established foundational mechanisms are progressively failing [2]. When innovation is no longer confined to specific tech parks, when core assets shift from tangible factories to intangible data and code, and when competitive advantages transition from economies of scale to ecosystem health and adaptability, we must ask: What factors drive the formation, development, and evolution of such a new ecosystem? The next step is to think about how to foster innovation and support economic development with the right guidance of public policy instead of distorted intervention. Of course, the answer to this question is not only related to our understanding of the regularity of innovation in the digital economy era, but also directly affects whether other countries can shape their own development paths and establish their future frameworks in the new global digital competition landscape. It is of great significance to explore the internal law of the evolution of digital entrepreneurship ecosystem and study the mechanism of the policy guidance in the construction of digital entrepreneurship ecological environment, so as to better grasp the internal logic and rules behind the practical effects of digital entrepreneurship practice and policy. In terms of theoretical framework, the development of digital entrepreneurship ecosystems requires interdisciplinary paradigm integration. Treating digital technology merely as an exogenous shock or production tool cannot fundamentally clarify the mechanisms driving the evolution of digital entrepreneurship ecosystems [3]. We should start from the structure, dynamic and evolution path of digital entrepreneurship ecosystem, and integrate the concepts of emergence, adaptability and path dependence into the theories of network, institutional entrepreneurship and knowledge spillover [4]. This paper constructs an analytical framework of how the entrepreneurial activities in the digital era form and develop self-organization, how they co-evolve, and how they experience creative destruction. On this basis, it further proposes how to explore new paths for the development of the real economy from the macro level. The fundamental reason for the digital entrepreneurship ecosystem to move from disorder to order and from quantitative change to qualitative change is found from the three levels of the co-evolution process: technology availability, subject strategy interaction and institutional environment. Based on the above reasons, we should construct a more integrated

theoretical perspective to answer "what is this" and "why is this so", and more importantly, to answer how to guide "how to do" by public policy after confirming that public policy has the guiding function. This is a theoretical speculation to fill the gap in the current theory and to address the global governance challenge of innovative policies in the digital age.

2 Theoretical Reconstruction of Entrepreneurship Ecosystem in the Digital Age

2.1 Evolution of Core Concepts

The theory of entrepreneurial ecosystem is developed with the characteristics of economic and social development, from geographical agglomeration to network connection, from factor superposition to system symbiosis, and then to a new paradigm catalyzed by digital technology. The exploration of new participants and prerequisites beyond geographical distance, which were rarely mentioned in the past, can be traced back to Marshall's theory of industrial districts [5]. The revolutionary impact of digital technology has significantly challenged this theoretical foundation. A list of factors cannot explain how a region with almost no other resource advantages has become a hub for entrepreneurship in a short time through digital connectivity. The reconstructed ecosystem has expanded its scope, while its core characteristics—dynamic, complex, and self-organizing—have become more distinct. This marks a shift from merely identifying essential elements to leveraging digital intelligence for strategic deployment and exponential growth. The key lies in understanding one's strengths while focusing on practical application.

2.2 Analysis of System Components

The digital entrepreneurship ecosystem is composed of hierarchical and dynamic elements, which can be decomposed into three layers: infrastructure, core activities, and regulatory culture. Elements at each level are tightly coupled through digital connections. The infrastructure layer is the digital cornerstone of the ecosystem, distinct from physical entities like road networks or buildings. It primarily comprises: ubiquitous interconnected network facilities, elastic and scalable computing power, open and shared technical components, and data resource pools—one of the most critical production assets in the digital era. Infrastructure enables digital entrepreneurship by providing near-zero marginal costs for trial and error, verification, and scaling.

The regulatory culture layer constitutes the soft environment for the healthy evolution of the system. It includes: 1) Formal regulations, namely laws, regulations, and policies adapted to the digital economy, such as the Data Security Law, platform anti-monopoly guidelines, and digital economy tax policies; 2) Technical regulations, which are embedded in platforms and code (e. g., algorithmic recommendation logic and default privacy settings), essentially form the daily governance framework; . 3) Cultural norms, including an entrepreneurial culture that encourages open collaboration, rapid iteration, and failure tolerance, as well as a social consensus emphasizing data ethics and user value.

2.3 Essential Characteristics of Digital Ecosystems

The digital entrepreneurship ecosystem demonstrates essential characteristics that are fundamentally different from traditional economic organizational forms. These characteristics are rooted in the fundamental attributes of digital technology and collectively shape its unique evolutionary dynamics. First, data-driven and algorithmic coordination. Data has replaced the central role of traditional production factors, becoming the "new energy" and "new raw material" for system operations. Second, platform dominance and modular symbiosis. Digital platforms (such as operating systems, social networks, and cloud computing platforms) constitute the core architecture of ecosystems. They decompose complex systems into composable modules by providing standardized interfaces (APIs) and services. Third, network effects and exponential growth constitute the most potent growth mechanisms in digital ecosystems. Both direct network effects (where more users mean more available features) and indirect network effects (where increasing user numbers on one side attract more users on the other) are amplified on the internet. Fourth, ecosystems are characterized by ambiguous boundaries and dynamic evolution. For instance, the e-commerce ecosystem can expand into finance (payment, loans), logistics, and cloud computing, while the social ecosystem may integrate with entertainment, e-commerce, education, and other sectors. The reason is that the data is general data, there is no obvious boundary between various fields. The platform operation mode can interpenetrate and combine various industries.

2.4 Comparative analysis with traditional ecosystems

The digital entrepreneurship ecosystem differs fundamentally from traditional industrial clusters or commercial ecosystems. It is not merely a digital upgrade of the latter, but involves radical transformations in its core logic, operational mechanisms, and evolutionary trajectories. This constitutes the fundamental premise for clarifying the paradigm shift in innovation during the digital era. Unlike the value creation logic of traditional linear value chains, digital ecosystems operate on value network principles. Value is progressively created, transformed, and enhanced across nodes including R&D, production, marketing, and service. While traditional systems prioritize cost reduction and efficiency gains, digital ecosystems focus on maximizing user value across diverse scenarios. In terms of governance and coordination, traditional systems mainly rely on market contracts, social relationships (such as trust and reputation), or formal rules of localities and industries for coordination. In contrast, the coordination in digital ecosystems operates under a dual governance model of algorithms and contracts. The traditional system is a gradual process in evolutionary dynamics,

which is affected by the technology life cycle, the change of factor cost and the regional policy, and it has strong path dependence; while the digital ecosystem is a sudden, cross-border and uncertain evolutionary process.

3 Dynamic Evolution Mechanism of Digital Entrepreneurship Ecosystem

3.1 Evolutionary Dynamics System Analysis

The evolution of digital entrepreneurship ecosystem is not a linear single-factor process, but a systematic process of the combination of technology, market, institution and culture. The technological driving force constitutes the underlying engine of system evolution. The market pull drives the direction of evolution from the demand side. Institutional shaping power provides the framework and boundaries for evolution. Cultural catalytic force serves as the "social software" for system evolution.

3.2 Evolutionary Stage Characteristics and Critical Turning Points

The evolution of digital entrepreneurship ecosystems exhibits distinct phase characteristics, with each stage featuring unique structural traits and marked by pivotal transition points. Mastering these phases and transition points is crucial for comprehending the evolutionary patterns of digital entrepreneurship ecosystems. The first stage: the budding stage, the initial "connection" and the initial "opportunity". The second stage is expansion, in which the network effect triggers accelerated development. The third stage is the mature stage, in which a relatively stable platform is formed, and the norms and rules as well as the stable power structure are established. The last stage is Renewal/Decline, in which the stage of qualitative transformation driven by disruptive technologies or business models. This phase emerges when disruptive innovations like AI-powered large models revolutionize traditional software, or when decentralized applications (DApps) pose a significant threat to centralized platforms.

3.3 Key Feedback Mechanism

The dynamic evolution of the digital entrepreneurship ecosystem stems from positive and negative feedback loops. Amplified by digital technologies, these feedback mechanisms exhibit heightened intensity and accelerated velocity, ultimately resulting in highly nonlinear system behavior. The positive feedback loop is "success attracts resources, resources generate more success". The endogenous negative feedback includes three aspects. Firstly, the negative feedback loop of "success attracts resources, resources generate more success" stifles innovation. Secondly, the negative feedback loop stems from the escalating complexity of rules, interfaces, and interdependencies as ecosystems mature. Thirdly, it involves a trust deficit caused by imbalanced value distribution or the erosion of trust in entities trusted by users and key stakeholders due to privacy violations or factual distortions.

4 Restructuring of Policy Guidance Framework for Ecosystem Health

4.1 Transformation of Policy Paradigm

In the traditional industrialization era, the selective industrial policy, which is characterized by "selecting the winner", has played an important role in the catch-up development by concentrating resources to support specific industries, enterprises or technological routes. However, given the inherent characteristics of digital entrepreneurship ecosystems—high uncertainty, complex network structures, and rapid iterations—this policy paradigm is at risk of systemic failure. The core challenges lie in three key aspects: First, in the digital domain where technological paths rapidly converge and business models proliferate, decision-makers find it challenging to accurately predict future 'winners', and concentrated investments may easily lead to resource misallocation and market distortions. Secondly, the top-down direct intervention will destroy the emergence mechanism and self-organization vitality of the ecosystem, and inhibit the trial and error and innovation of multiple subjects. Finally, preferential policies for specific objects may cause unfair competition and induce "policy rent-seeking" rather than real innovation.

4.2 Basic Principles of Policy Design

To ensure the successful implementation of the "ecological governance" paradigm, three fundamental principles must be upheld: First, the principle of tiered policy implementation. The digital entrepreneurship ecosystem features a well-defined hierarchical structure, and policy measures should precisely address the key challenges at each tier. For the digital infrastructure layer, it is essential to ensure inclusive, secure, and advanced public goods. For the regulatory and cultural environment layer, policies should focus on establishing long-term trust and incentive mechanisms oriented toward the future, as well as improving the legal framework for the digital economy. Second, the principle of phased adaptation: Different stages of ecological development face distinct critical bottlenecks, requiring tailored policy packages. During the nascent phase, the focus should be on addressing the most pressing issues through policy measures. Policies must first act as catalysts to resolve developmental uncertainties and create fertile ground for breakthroughs. Specific measures may include mobilizing funds, attracting talent, fostering supportive environments, and streamlining procedures. Third, the principle of multi-stakeholder collaboration. Ecological governance is fundamentally about multi-party co-governance. The government should assess the situation, facilitate negotiations among diverse stakeholders, and fully

harness the enthusiasm of all potential participants. This fosters symbiotic partnerships, promotes coexistence and mutual prosperity, ensures orderly and healthy operations, and builds a collaborative governance network.

4.3 Constructing a policy toolkit from the perspective of ecological evolution stages

The matching rules are designed to adjust the policy toolbox according to the changes of the succession stage of the ecosystem [6]. The policy instruments for the budding ecosystem focus on "activation" and "connection", which include: 1) Catalytic financial instruments: Establish public seed funds and innovation vouchers to validate ideas and assess market viability, with exceptionally high risk tolerance; 2) Connectivity and Scenario Building Tools: Fund or host technology salons, startup competitions, and hackathons; establish proof-of-concept centers and early-stage incubators in universities and research institutes; create open data challenges to guide entrepreneurs in leveraging public data to solve problems; 3) Regulatory flexibility mechanisms: Implement a streamlined negative list system for market access, establish an initial regulatory framework of 'easy entry, strict oversight', and provide ample room for trial and error in new business models. To leverage the policy instruments of expansionary ecosystems for empowerment and regulation, the "Innovation Chain + Industrial Chain" policy toolkit focuses on three key aspects. The first is a large-scale empowerment tool, including the cultivation of government-guided funds and the collaboration of social capital in growth-stage venture capital funds. Implement inclusive policies such as the additional deduction policy for R&D expenses, preferential corporate income tax for software enterprises, subsidies for R&D intermediary fees, and pre-tax additional deductions for R&D expenses of high-tech enterprises; organize international exhibitions, displays, and matchmaking activities. Second, standardize competition and connectivity tools. In accordance with legal provisions, regulate platform enterprises with market dominance to prevent abuse of their dominant position for restricting competition. Establish and promote standardized connectivity measures such as data and API interface standards in relevant fields. Third, talent acceleration tools: expedite the rollout of enhanced technical immigration and green card systems, and support leading enterprises in collaborating with universities to develop customized talent development programs.

The policy instruments for mature and renewal stage ecosystems are mainly "reboot" and "transformation", which can be used in accordance with three principles [7]. The first is a disruptive innovation incentive tool, which provides long-term, stable, and non-competitive funding to enterprises engaged in basic research or cutting-edge exploration. Secondly, the system update promotes tools, encouraging large enterprises to create early application scenarios for explosive or breakthrough technologies through government procurement and application demonstrations. Third, transformation buffer and assistance tools: Establish a lifelong learning system covering digital skills relearning, provide transitional living security and career transition assistance for groups affected by technical unemployment, so that the fruits of the new industrial revolution can truly benefit the people and enhance social stability. The use of this toolbox requires accurate judgment of the stage of the corresponding ecosystem and targeted mobilization of the corresponding policy instruments.

5 Conclusion

This work presents the research object from three aspects: the theoretical connotation analysis of the entrepreneurial ecosystem in the digital era, the mechanism of the evolution process, and the logic of the relevant policy response. It is found that digital technology has been deeply integrated into entrepreneurial activities. This paper realizes the fundamental reshaping of the organizational mode and evolutionary path of entrepreneurial activities: the digital entrepreneurial ecosystem is a basic form with data-driven, platform-led, and network collaboration as its core essence, which is the result of the spiral evolution of multiple driving forces including endogenous collaborative technology, exogenous collaborative market, institutional culture of simultaneous education, and symbiotic embedding. In the cycle of the start-up, growth, maturity and innovation, the triple feedback mechanism is used to control and promote the dynamic growth or weakening. Based on the above understanding of the mechanism, this paper argues that in this context, the paradigm of public policy must shift from selective industrial policies that "pick winners" to adaptive ecological governance that promotes the overall "health" of ecosystems. The effective policy guidance should follow the basic principles of stratified policy, stage adaptation and multi-coordination, and establish the ecosystem life cycle.

References

[1] Sussan, F., & Acs, Z. J. (2017). The digital entrepreneurial ecosystem. Small business economics, 49(1):55-73.

[2] Song, A. K. (2019). The Digital Entrepreneurial Ecosystem—a critique and reconfiguration. Small Business Economics, 53(3):569-590.

[3] Aksoy, C. (2023). Digital business ecosystems: An environment of collaboration, innovation, and value creation in the digital age. Journal of business and trade, 4(2):156-180.

[4] Sahut, J. M., Iandoli, L., & Teulon, F. (2021). The age of digital entrepreneurship. Small Business Economics, 56(3):1159-1169.

[5] D'Angelo, S., Cavallo, A., Ghezzi, A., & Di Lorenzo, F. (2024). Understanding corporate entrepreneurship in the digital age: a review and research agenda. Review of Managerial Science, 18(12):3719-3774.

[6] Zahra, S. A., Liu, W., & Si, S. (2023). How digital technology promotes entrepreneurship in ecosystems. Technovation, 119, 102457.

[7] Cao, Z., & Shi, X. (2021). A systematic literature review of entrepreneurial ecosystems in advanced and emerging economies. Small Business Economics, 57(1):75-110.