

# *Analyzing the Supportive Role of Regional Innovation Ecosystems in the Growth of Technology Startups—A Case Study of Hangzhou's Six Small Dragons*

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**Abstract.** This paper explores how regional innovation ecosystems support the growth of technology startups, using Hangzhou's "Six Little Dragons" as a case study. Drawing on innovation ecosystem theory, regional innovation systems, and new trade theory, the study analyzes how talent, capital, and industrial coordination jointly shape firm development. The paper identifies three key mechanisms: sustained talent attraction and knowledge spillovers anchored in universities and research institutions; a full-lifecycle financial support system characterized by a "patient government" and patient capital that mitigates early-stage market failures; and industrial chain coordination combined with scenario-based innovation that accelerates technology validation and market entry. The findings suggest that the success of Hangzhou's technology firms stems from systematic ecosystem interactions rather than isolated firm-level advantages, offering policy-relevant insights for enhancing regional innovation capacity in other cities.

**Keywords:** Regional innovation ecosystem, Technology startups, Hangzhou

## **1. Introduction**

In the midst of a new round of worldwide technological revolution and industrial transformation, emerging technologies, such as AI, intelligent manufacturing, and virtual reality, are transforming the fabric of the world's economy and industries. Developed countries such as the United States, the EU, and Japan have sped up their innovation ecosystem construction by enhancing scientific research capability, strengthening entrepreneurship, and promoting industrial concentration, thus enabling faster development of technology-frontier firms [1]. The US Silicon Valley is an archetypal case: by co-evolving venture capital and university research, entrepreneurial incubation, and giant technology firms, it has evolved a regional innovation system that has generated global leaders like Google, Apple, and Tesla. From these experiences, we can see that the innovation ecosystem has become an important institutional basis for improving regional competitiveness and achieving high-quality economic growth.

Against the international background mentioned above, provinces and cities all over China are also making efforts to improve the regional innovation ecosystem with a view toward pursuing an innovation-driven development strategy. In recent years, the central government has put forward a

series of policy frameworks, such as the Outline of the National Innovation-Driven Development Strategy, the 14th Five-Year Plan for National Science and Technology Innovation, and the Regulations on Promoting the Commercialisation of Scientific and Technical Achievements—providing a systematic top-down design for technological innovation and knowledge commercialisation. Meanwhile, local governments have carried out a large number of explorations in the integration of innovation elements, institutional provision, and industry coordination. For instance, Hangzhou has introduced the "37 Measures on a Talent Ecosystem", issued the Administration Measures for Science and Technology Business Incubators, and enhanced complementary arrangements in technology finance, venture capital, and intellectual property rights protection. Other cities, including Shenzhen and Shanghai, also have implemented measures related to the attraction of top talent and venture capital for innovative enterprises, leading to a competition between the regions based on policy tools, human capital, and industry [2].

Against such a backdrop, Hangzhou has become one of China's leading hubs for technological innovation. With its high ability to attract talent, a thriving innovation hub, a complete industry chain, and a highly efficient policy ecosystem, the city has developed an enclave of high-growth technology companies with national, if not international, influence, which we refer to collectively as the Six High-Growth Technology Companies. These companies are on the cutting edge of technology for AI, robotics, VR, game engines, etc., and have made repeated major technological advances. For example, Unitree Robotics has been successful at commercialising humanoid robots internationally; Yunshen Technology has become one of the top unicorns in China's VR (virtual reality) industry; and Manycore Tech has helped sustain Hangzhou as a leader in the digital economy and intelligent manufacturing [3].

Crucially, this emergence of Hangzhou's "Six High-Growth Technology Firms" does not need to be viewed as a sequence of isolated entrepreneurial success stories; rather, it is an output from a synergetic regional innovation system. Via close interactions between the public sector (governments, academic and research organisations), financial resource holders, and firms—facilitated through institutional mechanisms, resource-sharing systems, and networking—an "innovation ecosystem chain" has been formed, which can support the development of firms in a systematic way. This phenomenon raises a key research issue: How can the Hangzhou regional innovation system offer multilayered support in nurturing the birth and growth of TBEs?

## 2. Literature review

The theoretical roots of studies on innovation ecosystems go back to Moore's notion of a "business ecosystem" [4]. With an ecological analogy, Moore envisioned firms, suppliers, customers, research institutes, and governments as evolving agents operating within an environment of collaborative and symbiotic relationships, thus establishing a theoretical basis for future research on innovation ecosystems [4]. Yet over time, studies have drifted away from focusing on firm-level strategic interaction in favour of system-level coordination toward innovation. As Adner suggests, the result of innovation does not come about through one individual firm but is made through patterned alignments among many actors within an ecosystem, emphasising the systemic aspect of value creation, i.e., technological innovation [5].

In research on local innovation systems, the RIS literature has offered a fundamental approach to understand the geography of innovation dynamics: According to NIS approaches introduced by Lundvall [6] and Nelson [7], institutions play a key role in innovation dynamics. On these lines, Cooke [8], and, more recently, Asheim [9] also show that the regionally rooted flows of knowledge, technological learning, and patterns of industrial specialisation are crucial drivers for a region's

innovative capacity. There is a large body of international empirical literature suggesting that typical regional innovation ecosystems rest upon the joint effects of multi-actor collaboration, university-related research infrastructure, entrepreneurship, and capital. To illustrate, we can look at the case of Saxenian's [10] comparison between Silicon Valley and Boston to see how open networks and labour mobility are key to the creation of local innovation clusters, while Breznitz's [11] study on Israel and Taiwan points to the role of institutional design and military–industrial research systems in enabling technology-based entrepreneurship.

In China, some Chinese researchers also developed home-grown theories to study the national innovation systems from a perspective of systemic robustness, symbiotic bodies, and the role of "ecosystem architects". These works have greatly enriched the contextualised understanding of innovation ecosystems in China. Firstly, building upon the notion of system resilience, Chengli Tang et al. define the innovation ecosystem as an open CAS and highlight its ability to keep functioning intact and innovate under exogenous shocks [12]. Studies based on the theory of the adaptive cycle have shown that high-tech zone innovation systems possess different aspects of robustness—namely, resilience, absorption, recovery, and transformation—and perpetually cycle through stages of exploitation, conservation, release, and reorganization. The empirical analysis of the high-tech industrial park in Hunan Province indicates that the comprehensive system robustness increased gradually from 2012 to 2020, even though there are strong spatial variations; in particular, recovery capability is an important limitation to the ultimate resilience of the system.

Third, based on the theory of symbiosis and the theory of dissipative structures, Yang Li also explains the openness of the regional innovation ecosystem from another perspective, as well as its nonlinear evolution process; through an empirical study in China's four major city clusters, it is found that there is a close coupling relationship between the input of innovation activities and the environment of innovation activities. The entire system evolves in a dissipative manner away from an equilibrium with low input and environment to one of high input and environment, capturing the combined effect of technology investment, institutional quality, and industrial restructuring on regional innovative systems [13].

Last but not least, Cai Dulong et al. analyze how important players change their roles at various development stages for RIEs in China from the view of an "ecosystem architect". The findings reveal that in the emergence stage the state acts as a designer by setting up systems with policy directives and funding; During the growth phase, leading enterprises gradually replace the government as a central driver and spread innovations across the ecosystem through demonstration effects. In the mature phase, the largest firms produce spillover benefits from technology diffusion and vertical linkages that significantly raise the efficiency of the entire system [14]. This analysis suggests that the Chinese development model has evolved from top-down political rule to sequential private sector hegemonies.

In general, domestic research has furthered knowledge on how to build a regional innovation ecosystem mechanism from the perspective of system resilience, structural change, and agent-based management. This knowledge provides a strong local theoretical basis to analyse the Hangzhou regional innovation system and the evolution of technology firms like "Six High-Growth Technology Firms." What's more, previous studies provide a systematic understanding of regional innovation and industrial development in terms of innovation ecosystem theory and new trade theory, respectively. The first highlights the role of multi-actor collaboration, information sharing, or institutional intermediation in innovation dynamics, while the second explains how industrial concentration, external economies of scale, and policies can foster competitiveness and firm growth in a region. However, there are still some shortcomings. Firstly, a lot of foreign literature is based on

market-driven logic, and they cannot explain the institutional function that local governments play in constructing ecosystems in China. Second, existing research lacks a systematic analysis of emerging cohorts of technology-based enterprises in China, particularly with regard to the recently ascendant and representative group known as Hangzhou's "Six High-Growth Technology Firms." Thus we need the regional innovation ecosystem perspective—integrated with the economic insight of new trade theory in terms of industrial agglomeration and policy support—for examining how major mechanisms like talent accumulation, capital mobilisation, and industrial chain coordination together drive the development of technology start-ups. Such an approach can provide new empirical evidence to advance the contextualised development of innovation ecosystem theory.

### 3. Theoretical foundation

When studying local systems of innovation, several theoretical concepts derived from both economic theory as well as research in innovation management can be used to give a solid basis for analysing how companies operating within new technologies grow: First, innovation ecosystem theory emphasizes that many actors—such as government, universities, firms, and finance—collectively boost a region's ability to innovate and spark the creation of new industries by working together in networks that integrate resources, knowledge flow, and organisational structure. The model can be especially helpful in describing the complex interrelations between firms' development, as well as how these interrelations affect a region's economic vitality.

In terms of economic theory, New Trade Theory provides new ideas for explaining regional differences in innovation ability and the formation mechanism of industry concentration. Krugman [15] suggests that industries with economies of scale and imperfect competition cause firms to agglomerate in certain locations for the purpose of reducing their average costs, increasing the division of labour, and improving general innovation effectiveness via knowledge spillovers. Agglomeration is therefore a reinforcing mechanism that strengthens a region's comparative advantage and its innovation performance.

Closely related to that line of thinking is the infant industry protection argument—put forth by writers such as Hamilton and List, and subsequently adopted by contemporary development economics—which stresses that governments can play a key role at an early stage for nascent industries. Through policies such as tax breaks, guided investment funds, and institutional support, governments can create important time windows for learning effects and scale accumulation. These interventions enable firms to move past initial market failures and high degrees of uncertainty and thus create conditions for later mass production and entry into international markets.

The above-mentioned theory is highly consistent with the practical situation of constructing an innovative ecological system by Chinese local governments, where the role of policy intervention is not necessarily mutually exclusive but dynamically complementary to that of market forces. Collectively, the paper takes the combination of innovation ecosystem theory and New Trade Theory as the main basis to analyse the growth mechanism of Hangzhou's Six High-Growth Technology Firms. From the perspective of talent accumulation, capital assistance, and industry-chain cooperation, the study is intended to identify which local innovation environments are conducive to tech start-up development, as well as to understand the associated institutional and economic mechanisms.

## 4. The supportive role of Hangzhou's regional ecosystem in the growth of the "Six Little Dragons" enterprises

### 4.1. Talent attraction and cultivation

Hangzhou's regional innovation system endows the "Six High-Growth Technology Firms" with an extensive and continuous supply of high-end human resources. The rise of Hangzhou as a major centre for technological innovation is due to its constantly enhanced agglomeration of talent and long-term accumulation of human resources. The strength lies in having world-class universities such as Zhejiang University and Westlake University, and the Hangzhou Branch of the Chinese Academy of Sciences, forming a stable and effective supply chain of high-end innovative talent.

Zhejiang University has an important function in cultivating entrepreneurs; for example, among the founders of the "Six High-Growth Technology Firms," Zhu Qiuguo—President and CEO of Deep Robotics (Yunshen Technology), Huang Xiaohuang—Founder of Manycore Tech (Kujiale), and Liang Wenfeng—founder of DeepSeek, are all graduates of ZJU. Zhejiang University alumni-founded companies are becoming flagships in cutting-edge industries, including robotics, intelligent design, and artificial intelligence, which highlights the important role played by this university in developing an educational environment for entrepreneurship as well as building the industrial ecosystem.

Besides cultivating domestic talent, Hangzhou also actively recruits foreign human capital. For instance, BrainCo was established by Dr. Han Bicheng, a graduate of Harvard University, and its main researchers are top-level scholars from institutions such as MIT and Tsinghua University. In order to maintain the sustainable development and long-term vitality of its innovation ecosystem, Hangzhou has also focused on recruiting young talent [3].

The massive agglomeration of high-skilled labour provides not only a direct source of technological capability but also generates significant knowledge spillover effects. When skill-intensive labour, innovation institutions, and firms are agglomerated, as argued by Krugman [15] in the context of New Trade Theory, the diffusion of information, technological spillovers, and collaborative innovation reduce innovation costs and improve total factor productivity [16]. Hangzhou's experience offers strong empirical evidence in support of this hypothesis: by creating a virtuous and self-reinforcing cycle between talent, innovation, and industry, the city has built a core engine underpinning its role as one of China's most significant hubs for technological innovation.

### 4.2. Capital investment and support

There are a large number of financing channels available to the Six High-Growth Technology Firms in Hangzhou at relatively low cost, which help alleviate the common problem of underdeveloped capital markets faced by start-up technology companies. As stressed by the infant industry protection argument associated with Krugman and earlier development economists, nascent high-tech firms often struggle to obtain traditional market-based financing at an early stage due to information opacity, high risk, high uncertainty, and untested business models. Hangzhou has therefore adopted a range of policies—including fiscal incentives, government-directed funds, and tax credits—to provide essential time horizons for learning and scaling up [16].

What makes Hangzhou's financing system unique is both the scale and scope of its funding, as well as its combination of a "patient government" approach with financial innovation. Building on government-sponsored science and technology funds that focus on early-stage, small-scale, and innovation-oriented investment, Hangzhou has mobilised large amounts of patient capital, such as

insurance funds, through layered and indirect investment vehicles. This "parent government fund–industry fund–technology company" structure integrates insurance capital, state-owned capital, and private investment into a broader ecosystem for innovation and entrepreneurship.

For instance, major insurance companies such as China Life Insurance, China Pacific Insurance, and AIA Group have participated in investments through private equity funds and state-guided funds as anchor investors, indirectly holding equity stakes in enterprises like Yunshen Technology, Youshu Robotics, and BrainTech [17]. This hybrid system of policy capital and patient capital effectively disperses the risks and exit uncertainties faced by early-stage technology enterprises, thereby establishing an innovative financial network based on risk-sharing and profit-sharing

Significantly, the Hangzhou's strategy is not only for the early-stage investment, but also for providing the financial support for the company's whole lifecycle. at the same time, the government capital and insurance capital will accompany enterprises from the angle of investment to the companies' mature stage. For example, in 2018, Yunsheng Technology completed the angle round financing with the participating from the technology funds in hangzhou. Meanwhile, the insurance capital also achieved indirect participation and support in Zhaopin's Series B financing [17].

At the same time, beyond the financial support, the hangzhou's government also provides some physical diversified support, such as industrial space, policy alignment, and application scenarios. They hope to build a comprehensive "investment-service-scenario-exit" ecosystem for providing a better "living conditions" for businesses. Therefore, those technology companies not only gain the financial supports from the government, but also gain benefits from the local resources, thus reducing the cost of survival and innovation.

At the macro perspective, until February 2025, we noticed that the approved scale of Hangzhou's science and technology investment funds had cumulatively exceeded RMB 185 billion, and it helped around 120 enterprises in achieving listings or mergers and acquisitions successfully [18]. Based on research, it shows that this kind of risk-sharing and reward-sharing mechanism has significantly lowered the entry barriers and innovation costs for emerging technology companies, and helps them gain more power of competition. For example, DeepSeek has successfully developed a large-scale AI model with just \$6 million in funding and approximately 2,000 NVIDIA H800 GPUs, it is far fewer resources than industry giants. it shows that the role of concentrated investment and sustained government support for companies [19]. Overall, the capital investment strategy of Hangzhou's government is helpful for the development of technology companies, and has successfully supported the success of those companies.

### 4.3. Building and coordinating industrial chains

The local innovation ecosystem in Hangzhou provides the systemic support for the Hangzhou Six Little Dragons through driving the local industrial chain collaboration. This means that when the relevant enterprises, universities and some service providers come into one specific areas and collaborate with each other, it will reduce the costs of gaining knowledge, experience and the communication. Therefore, when the companies join into this area, it may help them to gain higher speed for growth.

Under this kind of situation, Hangzhou has formed an industrial ecosystem in smart IoT, advanced manufacturing, biopharmaceuticals, new materials, and green energy. for example, in Hangzhou's Binjiang District, the government had organised a 217 industry matchmaking events, and this events has attracted 5478 enterprises to join, and has promoted 274 companies to have collaboration [20].

More importantly, Hangzhou has already broken the limitation of the model of dominating solely by the "leading enterprises" in traditional collaboration. It tries to let the small and medium-sized technology companies participate in key areas of industrial development. One typical example is that the deployment of Unitree Robotics' robotic dogs during the 2023 Hangzhou Asian Games. This application has been made possible primarily through the strong promotion and support of the government [21].

In summary, Hangzhou has created a low-cost, high-efficiency development environment for "Hangzhou Six Little Dragons". For achieving this, the government has integrated the industrial agglomeration effects, policy coordination, and scenario openness, and this innovation ecosystem not only promotes the technology diffusion and enterprise upgrading, but also provides an effective platform for technology companies to gain more power for global competition at the start stage.

## 5. Policy implications

According to learning the method of how the Hangzhou government nurtures the Hangzhou Six Little Dragons, there are lots of experiences and approaches that other local governments in China could take example. For example, the local government needs to reduce attention for short-term output and growth, and shift to the model of building a long-term growing environment or ecosystem for companies. For achieving this long-term goal, the government needs to reduce the reliance on "leading enterprises", and pay more attention to supporting and nurturing the small-middle sized companies, such as providing support in finance, technology, social resources, etc. More specifically, cities should better coordinate government funds and market investments to jointly support the development of innovative enterprises. For example, through a "fund-of-funds—sub-fund—enterprise" structure, capital can cover the entire lifecycle of a company from startup to growth, while also helping businesses navigate their most challenging phases, thereby reducing long-term financing pressures. At the same time, local governments must go beyond merely providing funds; they should offer tangible support in areas such as land, factory space, approvals, and market access. By opening up real-world application scenarios and strengthening industrial chain collaboration, new technologies can be deployed and brought to market more rapidly. This helps enterprises establish a solid foothold locally and gradually expand into larger markets.

## 6. Conclusion

Overall, the development of Hangzhou's "Six Little Dragons" demonstrates that a strong regional innovation ecosystem (including the integration and collaboration between policies, capital, talent, and industry) could become the important foundation for the growth of technology enterprises. According to Hangzhou's experience, it shows that when governments build a greater patience, prioritize long-term support, and guide enterprises through funding and systematic services, the innovation will no longer be merely the success of individual enterprises, but also will become the capability for a region's sustainable development. Of course, this study primarily draws from the Hangzhou case, which benefits from inherent advantages in resources and institutional environments in Hangzhou. Whether these experiences are applicable to other cities still requires further testing. In the future, more comparative research and data analysis can provide deeper insights into how regional innovation ecosystems support the long-term growth of technology companies.

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