

Preface

Innovation serves as a crucial pillar driving economic and social development, and more importantly, constitutes the driving force behind China's strategy to become a global leader in science and technology (Wang Weinan et al., 2019). As dynamic and prominent players within the innovation ecosystem, technology-based startups play a pivotal role in advancing the development goals of building science and technology innovation hubs. In April 2020, Shanghai witnessed a total of 11,807 enterprises applying for the Technology Innovation Fund for Small and Medium-sized Technology-based Enterprises—a 62.7% year-on-year growth—with startups and micro-enterprises forming the core contributors. This demonstrates the unprecedented innovative vitality exhibited by technology-based startups. According to the Measures on Supporting the Accelerated Innovation Development of Technology-based Small and Medium-sized Enterprises in the New Era issued by the Ministry of Science and Technology in August 2019, key strategic initiatives to bolster their innovation-driven growth include: optimizing the innovation ecosystem, channeling innovation resources toward technology-based SMEs, expanding their scale, and enhancing their innovation capacity. The innovation ecosystem provides essential fertile ground for technology-based startups to overcome resource constraints, acquire external resources, and enhance their resilience. It functions as a regional long-term development mechanism that synergistically strengthens their capability to pioneer innovations while stimulating their inherent vitality and momentum for innovation (Liu Xielin et al., 2018).

Anti-fragility capability denotes the sustainable development capacity through which systems or organizations derive benefits from uncertain contexts, offering a novel theoretical lens for examining innovation activities in startups amid volatility (Meissner & Wulf, 2015). Throughout their “0-to-1” development journey, startups perpetually navigate uncertainty where market, technological, financial, and social resources exhibit extreme volatility, posing critical challenges to survival and growth (Wang Yuhui, 2019). For technology-based startups specifically, such environments necessitate heightened agility in capturing market intelligence, accelerated technological innovation cycles, and responsive access to funding. Paradoxically, stable external conditions—characterized by predictable resource flows—may impede technological innovation in these ventures. Consequently, uncertainty not only presents innovation opportunities but also stimulates innovation momentum. The COVID-19 pandemic originating in Asia in early 2020 rapidly proliferated globally, triggering economic crises and normalizing uncertainty. Notably, during this crisis, select technology-based startups demonstrated resilience by “turning crisis into opportunity”—identifying openings within

the black swan event to sustain rapid growth while contributing substantially to economic stabilization through innovation-driven resumption of work and production. Illustrative cases include Shanghai-based biotech startups prioritizing innovative vaccine development under the “Three Critical Pandemic Response Objectives,” and Nanjing’s Qixia District enterprises pioneering COVID-19 test kits—notably Jiangsu’s first entity securing National Class III Medical Device Registration. Such exponential growth stemmed not from isolated efforts but from the anti-fragility capability of their innovation ecosystems, which enabled effective resource provisioning and agile scientific decision-making.

This research project focuses on the resilient responses of technology-based startups during the pandemic, examining the formation and evolution of anti-fragility capabilities within innovation ecosystem networks and their relationship with the innovative development of these startups. As the comprehensive report of this project, it addresses five primary research dimensions as detailed below:

I. Status and Trends of Technology-Based Startups and Their Innovation Ecosystem in Shanghai.

II. Theoretical Frameworks of Anti-Fragility Capability in Innovation Ecosystems for Technology-Based Startups.

III. Case Studies on the Formation and Evolution of Anti-Fragility Capability in Innovation Ecosystems.

IV. QCA (Qualitative Comparative Analysis) of Anti-Fragility Capability Formation and Evolution Mechanisms.

V. Promoting Anti-Fragility Capability: Key Issues, Lessons, and Recommendations for Innovation Ecosystem Development.