Innovation Ecosystem of University Think Tanks: Theoretical Model, Innovation Mechanism, and Development Recommendations (Postprint)

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Abstract

[Purpose/Significance] From an ecological perspective, this study investigates the regular patterns of diversity, self-organization, and dynamics within university think tank innovation systems, aiming to identify the critical processes and junctures of their evolution, thereby fostering the generation of innovative ideas and models and elevating the development standards of university think tanks. [Method/Process] Through literature analysis and the inductive abstraction of factual survey data, a theoretical model of the university think tank innovation ecosystem was constructed and elucidated from three dimensions: biological metaphor, internal (micro) innovation ecology, and external (macro) innovation ecology. [Results/Conclusions] In the internal innovation ecosystem, university think tanks function as an innovation environment, facilitating knowledge innovation, organizational innovation, and institutional innovation among micro-level innovation actors; in the external innovation ecosystem, they operate as innovation actors, engaging in competitive collaboration with other ecological actors to formulate policy recommendations and shape public opinion orientation. The innovation mechanisms of the university think tank innovation ecosystem encompass self-organizing evolution centered on talent flow, open collaboration centered on knowledge flow, and market law regulation centered on value flow.

Full Text

University Think Tank Innovation Ecosystem: Theoretical Model, Innovation Mechanism, and Development Recommendations

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Abstract

[**Purpose/Significance**] This study employs an ecological perspective to investigate the patterns of diversity, self-organization, and dynamics within university think tank innovation systems, identifying critical processes and junctures in their evolution to foster the emergence of innovative ideas and models and enhance the development level of university think tanks.

[**Method/Process**] Based on literature analysis and synthesized empirical data, this paper constructs a theoretical model of the university think tank innovation ecosystem and explains the model from three aspects: biological metaphor, internal (micro) innovation ecology, and external (macro) innovation ecology.

[**Result/Conclusion**] In the internal innovation ecosystem, university think tanks function as the innovation environment, promoting knowledge innovation, organizational innovation, and institutional innovation among micro-level innovation actors. In the external innovation ecosystem, university think tanks serve as innovation actors themselves, competing and collaborating with other ecological actors to formulate policy recommendations and shape public opinion. The innovation mechanisms of the university think tank innovation ecosystem include self-organized evolution driven by talent flow, open collaboration driven by knowledge flow, and market law regulation driven by value flow.

Keywords: University think tanks, Innovation ecosystem, Innovation mechanism, Suggestions
Classification Number: C931.5

1. Problem Statement

After nearly 40 years of reform and opening up, China now stands at a critical stage of comprehensively advancing the modernization of socialism with Chinese characteristics, facing increasing opportunities and challenges in political, economic, cultural, social, and livelihood domains as reforms enter uncharted waters. Reform is a process of breaking the old and establishing the new, inevitably encountering various confusions and dilemmas, such as coexisting voices of support and opposition, conflicts between short-term interests and long-term goals, and imbalances between economic and ecological development. In this new era, advancing socialist construction with Chinese characteristics requires decision-makers to possess stronger resolve, insight, and foresight, which demands a more robust scientifically grounded and democratic decision-making consultation system. The times call for the wisdom of university think tanks, constituting the realistic background and inevitable requirement for their emergence and development. As a category of think tanks, university think tanks possess four advantages compared to official and social think tanks: First, they boast abundant talent and academic resources; second, they can promote synergy between basic and policy-oriented research; third, they can integrate research with student cultivation; and fourth, they inherit the spirit and culture

of universities, enabling them to maintain research independence and objectivity to the greatest extent.

University think tanks differ from traditional university departments, institutes, and research offices in organizational structure, research objects, methods, team building, management mechanisms, and resource allocation. From a micro perspective, university think tanks comprehensively utilize capital, technology, brand, and other elements to achieve knowledge innovation, organizational innovation, and institutional innovation. From a macro perspective, they cooperate and compete with other innovation actors and policy communities to form entirely new organizational interactions. As an emerging organizational form, both the content research and institutional development of university think tanks represent typical innovation processes. Innovation is a complex organizational behavior, and research paradigms on innovation have evolved through three stages: linear paradigm, network paradigm, and ecological paradigm. The innovation ecosystem research paradigm highlights the dynamic evolution and self-organized growth of organizational behavior, emphasizing the organic aggregation of various innovation elements. Although university think tanks have not existed for long, their development fully embodies the ecological characteristics of innovation systems, such as self-organized growth without absolute authority (or opinion leaders), relatively open organizational boundaries, diverse organizational forms, and high symbiosis with multiple types of organizations. Studying the innovation behavior of university think tanks from an ecological perspective can better characterize and predict the temporal dynamics and spatial network characteristics of their innovation.

2.1 Policy Networks and Knowledge Innovation

Policy networks represent a research approach formed by introducing network theory into policy science and decision-making systems, leading many scholars to study think tank construction based on the policy network theoretical framework [1-3]. Klijn [4] identifies three distinctive features of policy networks: interdependence among actors, policy networks as a process, and institutional constraints on network activities. Finlayson and Rhodes [5] consider network autonomy—where no supreme authority exists—as a key characteristic of policy networks. The interdependence and mutual constraints among actors, the dynamism of decision-making processes, and the self-organizing nature of networks already exhibit preliminary ecological characteristics. Meanwhile, since think tanks function as original knowledge contributors to overall or specific innovation issues [6], some scholars have begun examining think tanks from a knowledge innovation perspective [7-9], viewing them as knowledge innovation collectives built upon policy networks. Further, Wang Youyun et al. [10] connect think tanks, networks, and innovation, arguing that decision-making consultation constitutes a network structure of exchange and interaction that requires think tank platforms facilitating knowledge-power exchanges. Based on this, observing think tank issues through the lens of innovation ecology should

be an essential component of research on the development and construction of socialist think tanks with Chinese characteristics.

2.2 Innovation Ecosystem and University Think Tank Construction

In early 2003, the President' s Council of Advisors on Science and Technology formally introduced the concept of "Innovation Ecosystem" for the first time in the world. Zhao Fang et al. [11] define the theoretical framework of innovation ecosystems as comprising two key aspects: interdependence among actors and interaction between actors and their environment. Further, Hui Xingjie et al. [12] define innovation actors as tangible entities such as enterprises, universities, and research institutes, while innovation environmental elements include intangible resources like knowledge, information, culture, and institutions. Regarding the characteristics of innovation ecosystems, Zeng Guoping et al. [13] summarize them as dynamism, habitat characteristics, and growth potential, while Li Wan et al. [14] describe them as diverse symbiosis, self-organized evolution, and open collaboration. Innovation ecosystem theory represents the latest achievement in the deepening development of innovation theory. On one hand, it highlights the dynamic growth characteristics of innovation resources, emphasizing the self-organizing nature of innovation systems. On the other hand, innovation ecosystems are no longer isolated, closed networks but rather layers of superimposed and nested innovation networks. Innovation ecosystems interact, complexly connect, and co-evolve with ecological subsystems such as research and experimentation, manufacturing, intermediary auxiliary communities, internal innovation habitats within clusters, and external innovation environments [15]. The transition from innovation networks to innovation ecosystems essentially reflects four major shifts in contemporary innovation research regarding actors, functions, methods, and culture [16].

Studying think tank construction from an innovation ecosystem perspective represents a novel field with scarce relevant research literature both domestically and internationally. Bevilacqua [17] argues that think tanks serve as both innovation actors and innovation environments, triggering social transformation while promoting the evolution of innovation systems. McGann [18] contends that think tanks innovate in talent cultivation, quality assessment, independence, research coherence, product and service activities, development strategies, organizational structure, opportunity identification, partner and network building, influence expansion, research methods, and data utilization, emphasizing the diversity of think tank development directions and thereby deriving the fundamental characteristics of think tank innovation ecosystems. Think tank construction is a process of integrating and developing various resources to reconstruct or newly construct innovation ecologies. University think tanks, due to their distinctive advantages, increasingly function as information nodes within innovation networks. The significance of studying university think tank innovation systems from an ecological perspective lies in grasping the patterns

of diversity, self-organization, and dynamics in their development, identifying critical evolutionary processes and junctures, and promoting the emergence of innovative ideas and models to enhance the development level of university think tanks.

3. Research Process

Between May and September 2017, this study conducted online investigations of ten university think tanks, including the Institute of International and Strategic Studies at Peking University, Chongyang Institute for Financial Studies at Renmin University of China, Institute of International Relations at Tsinghua University, Institute of Contemporary China Studies at Nankai University, Institute of Economic and Social Development, National Intellectual Property Strategy Implementation (Tianjin University) Research Base, International Research Center for Chinese Cultural Heritage Protection, "Going Global" Investment Model and Management Think Tank for China' s Major Engineering Technology at Tianjin University of Technology, Food Safety Strategy and Management Research Center at Tianjin University of Science and Technology, and Airport Economic Research Center at Civil Aviation University of China. The research also conducted symposiums and in-depth interviews with directors and principal researchers from three think tanks: the Institute of Contemporary China Studies at Nankai University, the National Intellectual Property Strategy Implementation (Tianjin University) Research Base, and the International Research Center for Chinese Cultural Heritage Protection. Combined with analysis of the construction of the Binhai Development Research Institute at Nankai University, this study explores the internal structure, innovation mechanisms, and developmental patterns of university think tank innovation ecosystems. Based on summarization, induction, and abstraction of the research findings, this paper constructs a theoretical model of the university think tank innovation ecosystem and explains the model from three aspects: biological metaphor, internal (micro) innovation ecology, and external (macro) innovation ecology.

4.1 Biological Metaphor

The biological metaphor constitutes the foundational assumption of innovation ecosystem theory, viewing socio-economic organizations and phenomena through a biological lens to identify innovation producers, consumers, and decomposers, as well as interactions among innovation actors and between actors and their environment. Due to their unique resource endowments, university think tanks gradually develop into important structural holes within innovation networks—that is, nodes for multi-party relationships and information dissemination. Extending from policy innovation to knowledge innovation, organizational innovation, and institutional innovation, and expanding from policy networks to knowledge dissemination networks, cultural derivative networks, and intellectual interaction networks, an innovation ecology is formed (see Table 1).

Table 1 Comparison of Natural Ecosystems and University Think Tank Innovation Ecosystems

Natural Ecosystem	University Think Tank Innovation Ecosystem
Individual organisms with similar genomes	Individual university think tanks with similar values and cultures
Complexes composed of individuals of the same species	Think tank clusters composed of regional university think tanks
Complex network structures composed of various biological populations in a region	Complexes composed of university think tanks, other think tanks, government, media, public, etc.
Elements such as carbon, oxygen, hydrogen, nitrogen	Culture, knowledge, technology, etc.
Temperature, soil, water, etc.	Capital, facilities, policies, institutions, etc.
Phenomena such as banyan trees forming forests alone	Diverse games among various think tanks, interest groups, media, service institutions, and policy communities
Diversity	Interactions between university think tanks and parent universities, other think tanks, government, media, public, etc.
Symbiosis of multiple biological forms and environmental elements	University think tanks comprehensively utilizing capital, talent, policies, and other elements for continuous innovation
Complex relationships of interwoven influence among organisms and between organisms and abiotic entities	Growth, development, variation, and decline of university think tanks under environmental pressure
Dynamic distribution of biological populations within environments	
Competitive behaviors among populations	
Dynamic stability	
Evolution	
Evolution of species and environmental changes	

Similar to natural ecosystems, university think tank innovation ecosystems contain different types of species, populations, and communities that interact and influence each other with environmental elements such as culture, knowledge, technology, policies, and capital, collectively forming an innovation ecosystem that exhibits ecological characteristics of diversity, symbiosis, dynamic stability, and evolution. Externally, university think tanks compete, cooperate, and collaborate with various ecological actors based on innovation environmental elements. Internally, they comprehensively utilize elements such as capital, policies, and institutions to continuously innovate, providing a suitable micro-ecology for more microscopic innovation actors and promoting the spiral ascent of knowledge innovation.

4.2 Internal (Micro) Innovation Ecology

In the internal innovation ecosystem, university think tanks function as the innovation environment. Unlike traditional university research institutions, they form a special innovation "greenhouse" based on unique talent configurations, research funding, management systems, research methods, and evaluation approaches, thereby promoting, safeguarding, and supporting micro-level innovation actors—research and management personnel—in knowledge innovation, organizational innovation, and institutional innovation (Figure 1 [Figure 1: see original paper]).

First, from a creative perspective, think tank products essentially represent a knowledge innovation process in which researchers integrate and process data, materials, and information, combine them with their own tacit knowledge, employ appropriate research methods, and create valuable new ideas, viewpoints, and recommendations. University think tanks achieve relatively high knowledge innovation efficiency primarily because they possess complete theoretical systems, extensive experience, and abundant talent, and have established a data-based research methodology system. Conducting research according to academically recognized theoretical frameworks and procedural norms yields conclusions with strong neutrality and minimal subjective bias.

Second, university think tanks adopt flat organizational structures and goal-driven organizational strategies as basic principles for institutional setup, establishing an open and collaborative think tank brand and organizational culture. This weakens administrative management colors and flexibly assembles research teams around projects rather than departments, promoting the ice-breaking integration of personnel and institutions across philosophy, social sciences, and natural sciences in interdisciplinary and cross-institutional research processes.

Third, university think tanks innovate in management systems. Regarding personnel, they employ competitive talent recruitment systems, dynamic talent utilization systems, and humanized employee management systems—such as principal investigator responsibility systems, revolving door systems, and specially appointed researcher systems—that clearly differ from traditional talent manage-

ment approaches in universities and research institutions. Regarding funding, university think tank research funding management systems generally comply with parent university financial management frameworks but place greater emphasis on human intellectual contributions in terms of culture and value orientation. Regarding materials, university think tanks' proprietary databases, research report pools, and experimental equipment can be opened to all researchers, exploring intellectual property sharing.

Figure 1 Innovation Ecosystem of University Think Tank (Micro Perspective)

4.3 External (Macro) Innovation Ecology

In the external innovation ecosystem, university think tanks function as innovation actors, competing, cooperating, and collaborating with official think tanks, social think tanks, parent universities, interest groups, media, data/survey companies, and other ecological actors to formulate policy recommendations and shape public opinion, attempting to influence and guide decision-makers and the general public. The macro-level university innovation ecosystem contains three layers of relationships (Figure 2 [Figure 2: see original paper]):

First is the relationship between university think tanks and government. One of the most fundamental organizational goals of university think tanks is to influence government behavior through professional analysis and recommendations, serving the scientific and democratic decision-making of the Party and state. Therefore, university think tanks and government form a typical supply-demand relationship, with government as the demand side for consulting services such as policy alternatives, evaluation opinions, and policy recommendations, and university think tanks as the supply side. This demand-side market dominance forms the economic foundation for the emergence and development of the think tank industry.

Second is the relationship between university think tanks and other innovation actors. (1) University think tanks often collaborate with interest groups or official think tanks, leveraging interest groups' (such as regional chambers of commerce and industry associations) social networks and data information resources, as well as official think tanks' internal reference information and reporting channels, to jointly complete policy recommendations that influence government decision-making and shape social policies. (2) University think tanks and social think tanks independently choose competitive or cooperative models based on their respective research expertise and resource capabilities. Both also frequently collaborate with media to achieve goals of shaping public influence, identifying social issues, and promoting policy advocacy. No absolute dominant actor exists in these tripartite relationships; instead, actors play games based on optimal strategic choices in specific contexts, with relationship patterns potentially changing at any time while preventing any party from being eliminated from the market. This fully embodies the self-organizing and dynam-

ically stable characteristics of innovation ecosystems. (3) University think tanks maintain deeply coexistent relationships with parent universities. Parent universities support university think tanks in intellectual resources, research funds, and relationship networks, while university think tanks reciprocate through social influence, research propositions, research methods, and reputation.

Third is the relationship between university think tanks and the general public. University think tanks and the public maintain a two-way supply-demand relationship, exchanging value around information dissemination. On one hand, the public serves as both information providers and information demanders. On the other hand, university think tanks collect public demands and opinions, form political viewpoints, and communicate them to the public, during which the innovative knowledge, methods, and culture they uphold also spread.

Figure 2 Innovation Ecosystem of University Think Tank (Macro Perspective)

5.1 Self-Organized Evolution Centered on Talent Flow

Regardless of the innovation ecosystem, innovative talent represents the most fundamental and dynamic micro-level innovation actors. In university innovation ecosystems, as innovative talent flows, various innovation actors—including think tanks, universities, interest groups, service companies, and media—and the entire ecosystem evolve according to their own will, moving from disorder to order. Innovation talent within university think tanks divides into three categories: research talent, management talent, and hybrid talent. Research talent primarily undertakes knowledge innovation, management talent focuses on organizational and institutional innovation, while hybrid talent covers all three aspects.

One scenario of talent flow proceeds as follows: Stage (1) When the internal innovation environmental elements of a university think tank cannot satisfy talent innovation needs, innovative talent passively flows outward from the organization. Stage (2) When talent loss reaches a critical point, two possibilities emerge: organizational death or major transformation initiating organizational variation and beginning another life cycle. Stage (3) The reformed university think tank attracts talent backflow due to optimized innovation element allocation. Stage (4) However, when innovative talent exceeds the ecosystem' s resource carrying capacity, vicious competition arises from resource scarcity. Stage (5) This leads back to stage (1). Through talent flow, university think tanks gradually adjust to a relatively stable state.

Another talent flow scenario occurs when internal innovation environmental elements satisfy talent needs, enabling successful knowledge, organizational, or institutional innovation. Talent then actively carries their innovation experience to other institutions, conducting further composite innovation based on specific institutional contexts and optimizing knowledge, organization, and systems in those institutions. In this case, university think tanks may become innovation

"incubators," continuously attracting talent, absorbing external talent' s innovation experience and capabilities, providing innovation laboratories for talent, and subsequently exporting talent. Due to the spillover effects of certain successful university think tanks, the entire regional innovation ecosystem improves —a relatively optimistic dynamic equilibrium.

5.2 Open Collaboration Centered on Knowledge Flow

Universities constitute an important component of the national innovation system, with their researchers generating knowledge innovation through information acquisition, processing, and dissemination. Due to modern technological development, the exclusivity of information resources and research methods has weakened, breaking down barriers to private ownership of knowledge production materials. Knowledge frequently exists in a state of flow and sharing among various innovation actors. According to the DICE model of knowledge innovation ecology theory [19], in the long-term operation of knowledge distribution, interaction, competition, and evolution, multiple collaborative modes—including docking, complementarity, supply-demand, and integration—exist within innovation ecosystems due to different interest demands among innovation actors such as government, universities, research institutes, media, and intermediaries [20].

For example, as China vigorously implements the innovation-driven development strategy, various organizations occupy different positions along the knowledge chain within the resulting innovation ecosystem: the public serves as an information source, university think tanks function as knowledge producers, media and interest groups undertake supervision and coordination functions, and government and the public act as knowledge consumers. Along with the transfer, flow, and circulation of explicit and tacit knowledge along the knowledge chain, various innovation actors become ecological communities through collaboration and competition. In the era of big science, a policy proposition may involve multiple research fields such as political science, economics, sociology, cultural studies, environmental science, geography, and history, making it difficult for a single think tank to cover all these areas. Consequently, increasing numbers of university think tanks, official think tanks, social think tanks, and interest groups conduct collaborative research around the same proposition, promoting the externalization of tacit knowledge by transferring, sharing, and integrating their unique resources and capabilities. The process of knowledge flow itself constitutes open collaboration among innovation actors.

Over the past three years, around the national strategy of coordinated development of the Beijing-Tianjin-Hebei region, the Institute of Contemporary China Studies, Institute of Economic and Social Development, National Intellectual Property Strategy Implementation (Tianjin University) Research Base, and Tianjin International Development Research Institute at Tianjin Foreign Studies University have jointly applied for research projects and conducted collaborative studies based on their respective expertise in social governance,

logistics economics, intellectual property, and language culture. Knowledge spreads, shares, and deepens through investigation and discussion. These multiple think tanks have gradually shifted from discipline-based linear research paths to collaboration-based network research paths.

5.3 Market Law Regulation Centered on Value Flow

China' s think tank development has gradually assumed an industrialized development trend, fundamentally due to increasingly clear value flow. In university innovation ecosystems, policy product innovation emerges and follows market law regulation as value flows from social problem identification to government procurement. The value flow direction in university think tank innovation ecosystems roughly proceeds as follows: (1) Social problems and phenomena generate market demand; (2) With assistance from social or government sponsors, media, interest groups, or think tank researchers elevate these to policy issues, generating original policy innovation; (3) Government establishes demand, selects winners in the think tank market competition, and provides research start-up funding; (4) During complex research processes, various innovation actors interact crosswise, ultimately forming a compound innovation intellectual product; (5) The market value of intellectual products is determined by demand sides including government, media, and the public, with government often being the most direct purchaser; (6) Implementation of new policies triggers new market demand and social phenomena, initiating the next round of value flow and promoting continuous innovation in the intellectual domain.

The research process of the Tianjin private economy study group at Nankai University Binhai Development Research Institute particularly demonstrates this value flow: After tax system reforms, some private enterprises experienced increased rather than decreased tax burdens; the research group discovered this phenomenon during enterprise visits and reported it to local government; after government established policy research demand and funded the research, the group conducted in-depth studies on the causes and solutions of this problem in collaboration with federations of industry and commerce, industry associations, and regional chambers of commerce, submitting research reports such as "Four Suggestions for Effectively Reducing Real Economy Burdens" ; during this research process, the group gradually recognized the importance of evaluating policy implementation effects, which gained recognition from management departments, thus establishing new policy research issues. The economic characteristics of university think tank innovation ecosystems include dual market structures, diversified competition, and clear value signals [21], with market laws regulating value input, flow, and output, thereby influencing the allocation and combination of innovation elements and the timing and location of innovation emergence.

The three innovation mechanisms discussed herein do not operate independently but rather intersect and influence each other, collectively promoting ecosystem development, enhancing innovation efficiency, and generating specific innovation

products and behaviors.

6. Suggestions for Ecological Development of University Think Tanks

University think tank development should grasp the ecological characteristics of diversity, symbiosis, dynamic stability, and evolution, coordinate internal and external innovation actors and elements, serve as an intermediate stack connecting innovation resources [22], optimize the combination of innovation actors and elements, match resource supply with think tank industry development demands, form university think tank industry innovation clusters, and maximize the promotion of knowledge, organizational, and institutional innovation by innovative talent.

First, increase the diversity of ecological actors. As discussed above, in the era of big science, the innovation paradigm has shifted from intra-organizational linear innovation to network innovation aggregated from point breakthroughs. Except for some long-established, large-scale comprehensive think tanks, university think tank builders should focus on cultivating various think tanks with distinctive research features, such as innovation, science and technology, defense, social governance, and international relations. Additionally, beyond traditional university think tank organizational forms, more types of innovation actors should be constructed with more open, collaborative, and shared concepts. For example, establishing think tank alliances according to region, type, and research direction enables university think tanks to encounter problems and be able to utilize alliance strength to openly promote various linkage possibilities. Moreover, university think tanks should not rigidly adhere to their organizational boundaries but should integrate with industry experts, government, media, and social think tanks, breaking through systemic limitations to attempt establishing new organizational types based on shared interests, values, and beliefs, thereby enriching innovation actor forms. This poses high demands and challenges for think tank managers.

Second, enhance the integrity of the ecological environment. A healthy university think tank innovation ecosystem largely depends on sound environmental elements such as robust policies and regulations, mature decision-making consultation systems, flexible management mechanisms, and adequate funding, particularly the construction of think tank culture. Currently, university think tanks lack cultural identity, suffer from marginalization and rigid management systems, and researchers lack belonging in traditional disciplinary systems. This requires researchers to study not only think tank research but also think tanks themselves. Establishing industry standards and disciplinary systems, developing innovative methodology systems and data information systems, supporting professional policy analysis research based on data information, and enhancing cultural identity and researchers' innovative competitiveness in university think tanks are essential.

Third, on the basis of increasing actor diversity and enhancing environmental integrity, elevate the interdependence between innovation actors and between actors and environment. University think tanks should fully leverage university talent and disciplinary advantages, draw on natural science research methods, promote cross-penetration between philosophy, social sciences, and natural sciences, and innovate and enrich research paths and carriers for applied policy research. For example, jointly applying for research projects under the names of multiple colleges and think tanks; university think tanks collaborating with intelligence agencies on policy research, fully leveraging the advantages of university think tanks in information analysis, policy result expression, and recommendation construction, along with intelligence agencies' expertise in information collection, data mining, and website monitoring; university think tanks cooperating with social media to establish think tank brand images and disseminate research results. Sufficient interdependence between ecological actors and elements is equivalent to establishing new connection patterns between neurons—adding a pathway in the innovation network triggers a series of chain changes in information transmission patterns, driving the entire ecosystem toward more open and dynamic evolution.

Fourth, expand the ecosystem. Building upon the first three steps, university think tank innovation ecosystems should further expand to enhance system openness from an ecological perspective. Examples include exchanging and integrating with other regional innovation ecosystems and linking international innovation resources; expanding research temporal and spatial perspectives without being constrained by temporary and local government demands to produce public policy research achievements that withstand historical tests; exploring development models of platform-based think tank institutions and maker-based researchers; guiding policy resource flow through innovative talent flow to become carriers of urban innovation. These represent important breakthrough points for university think tanks along ecological development paths. Additionally, we should fully understand and accept the dynamic balance of university think tank ecosystems. Due to talent mobility, fluctuations in quantity and structural changes in any individual university think tank, the university think tank population, or other innovation actors constitute normal phenomena. Such changes are not subject to human will but continuously tend toward dynamic equilibrium. Think tank managers should establish various mechanisms based on this concept, including talent introduction and export, think tank research evaluation and review, and think tank institution access and exit mechanisms.

7. Conclusion

This paper constructs a theoretical model of the university think tank innovation ecosystem from an ecological perspective and explains the model from three aspects: biological metaphor, internal (micro) innovation ecology, and external (macro) innovation ecology. The study finds that, similar to natural ecosystems, university think tank innovation ecosystems contain different types

of species, populations, and communities that interact and influence each other with environmental elements such as culture, knowledge, technology, policies, and capital, collectively forming an innovation ecosystem. In the internal innovation ecosystem, university think tanks function as the innovation environment, promoting, safeguarding, and supporting micro-level innovation actors in knowledge, organizational, and institutional innovation. In the external innovation ecosystem, university think tanks serve as innovation actors, competing and collaborating with other ecological actors to formulate policy recommendations and shape public opinion. The study elaborates on three innovation mechanisms of university think tank innovation ecosystems: self-organized evolution driven by talent flow, open collaboration driven by knowledge flow, and market law regulation driven by value flow. The research suggests that university think tank managers, builders, and researchers should fully understand the ecological characteristics of university think tank innovation systems and construct new-type university think tanks with Chinese characteristics by increasing ecological actor diversity, enhancing ecological environmental integrity, elevating interdependence between actors and environment, and expanding the ecosystem, thereby improving decision-making consultation service levels and government scientific decision-making capabilities.

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Note: Figure translations are in progress. See original paper for figures.