World-Class Science and Technology Innovation Urban Agglomeration: Postprint of the Common Choice of Yangtze River Delta Integration and Shanghai Science and Technology Innovation Center

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Abstract

[Purpose/Significance] As the world' s sixth-largest metropolitan area, the Yangtze River Delta' s pioneering construction of a world-class scientific and technological innovation urban agglomeration is of great significance for China to implement the innovation-driven development strategy, transform its development pattern, and embrace the new technological revolution and industrial transformation. [Methods/Process] This paper proposes development approaches by analyzing current status and problems, envisioning future prospects, and particularly by integrating the consideration and strategic deduction of scientific and technological innovation functions with urban (agglomeration) spatial layout. [Results/Conclusion] With the formation and development of Shanghai' s science and technology innovation center and collaborative innovation in the Yangtze River Delta as important strategic levers, the future Yangtze River Delta urban agglomeration will be able to develop into a world-class scientific and technological innovation urban agglomeration.

Full Text

Preamble

World-class Urban Agglomeration of Science and Technology Innovation: A Common Choice for Yangtze River Delta Integration and Shanghai' s Science and Technology Innovation Center

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Abstract

[**Purpose/Significance**] As the world' s sixth largest urban agglomeration, the Yangtze River Delta' s pioneering effort to build a world-class science and technology innovation urban agglomeration holds great significance for China' s implementation of an innovation-driven development strategy, transformation of its growth model, and response to the new scientific and technological revolution and industrial transformation. [**Method/Process**] This paper proposes a developmental approach by analyzing current conditions and future visions, particularly by integrating the functions of scientific and technological innovation with the spatial layout of cities and urban agglomerations. [**Result/Conclusion**] With the formation and development of Shanghai' s science and technology innovation center and collaborative innovation in the Yangtze River Delta as crucial strategic levers, the Yangtze River Delta urban agglomeration will be able to evolve into a world-class science and technology innovation urban agglomeration.

Keywords: scientific and technological innovation, urban agglomeration, Yangtze River Delta, integration, Shanghai, world-class

Classification Number: F127

Shanghai is building itself into a globally influential center for economy, finance, trade, shipping, and scientific and technological innovation, as well as an international cultural metropolis—an endeavor that inevitably relies on Yangtze River Delta integration as its foundation. Meanwhile, the Yangtze River Delta' s pioneering and high-quality development urgently requires enhancing the scientific and technological innovation capacity and strength of the urban agglomeration with Shanghai at its core. It can be said that transforming the Yangtze River Delta into a world-class science and technology innovation urban agglomeration, making it a strategic pivot for China' s regional development, represents a key element in implementing the nation' s innovation-driven development strategy.

1.1 The Rise of Science and Technology Innovation Urban Agglomerations: Evolution of Urban Functions and Socioeconomic Development

During the industrial economy era, central cities and their urban agglomerations primarily functioned as manufacturing and shipping-trade hubs. In the knowledge economy era, the functions of central cities and their industrial structures have further upgraded and transformed, with scientific and technological innovation—embodying knowledge creation—becoming the core function. Within urban agglomerations, hierarchical classification and collaborative coordination are now based on the strength, capacity, and vitality of scientific and technological innovation.

The pioneers in moving toward science and technology innovation urban agglomerations have been global cities and their urban agglomerations in developed

countries and regions. Silicon Valley represents a typical science and technology innovation urban agglomeration worldwide, with San Francisco at its core, stretching along Highway 101 to San Jose, where thousands of high-tech companies are distributed across a series of cities. In recent years, New York has become the city providing the second-most technology jobs after Silicon Valley, emerging as an important science and technology innovation center on the U.S. East Coast, while the Boston-New York-Washington urban agglomeration has also become a significant science and technology innovation urban agglomeration.

In the United Kingdom, the urban agglomeration centered on London and encompassing Oxford and Cambridge hosts world-leading intelligent technology flagship enterprises such as Arm and DeepMind. In Japan, an ultra-intelligent urban agglomeration based on informatization is being constructed, with Tokyo at its core and Tsukuba Science City as an important carrier.

1.2 Connotations and Characteristics of Science and Technology Innovation Urban Agglomerations

A science and technology innovation urban agglomeration refers to those urban agglomerations where scientific and technological innovation serves as the core function. Within these agglomerations, urban hierarchies and their interrelationships are primarily measured by the yardstick of scientific and technological innovation. Supported and guided by scientific and technological innovation, the economic, social, cultural, and ecological functions of cities advance to higher stages.

The core function and value orientation of science and technology innovation urban agglomerations is to promote scientific and technological progress and innovative development, driving the overall optimization and upgrading of the urban agglomeration. Economic growth increasingly derives from new momentum catalyzed by scientific and technological innovation, social progress increasingly benefits from new means provided by scientific and technological innovation, and urban culture and ecology become compatible with scientific and technological innovation.

Science and technology innovation urban agglomerations possess abundant scientific and technological innovation resources and diverse innovation actors, attracting large numbers of scientists, engineers, entrepreneurs, innovators, designers, and young scientific and technological innovation talents. Universities, research institutes, incubators, and testing platforms are widespread. World-class science and technology innovation urban agglomerations have the strength and capacity for global allocation of scientific and technological innovation resources, with dense multinational R&D and innovation institutions that link to and influence the world, becoming important birthplaces of global scientific and technological waves.

World-class science and technology innovation urban agglomerations are pio-

neers, leaders, and definers of institutional innovation worldwide. They are destinations for global talent and "restless" individuals, characterized by cultural inclusiveness, ecological beauty, entrepreneurial convenience, and market openness. They possess first-class innovation ecosystems and governance systems, serve as birthplaces of emerging industry regulations, birthplaces of future research, innovation, and service organizations, and exemplars of innovative policies.

As the new scientific and technological revolution and industrial transformation deepen, scientific and technological innovation becomes even more crucial for global cities and their urban agglomerations. New technologies and products will be developed and applied here first, new models and business forms will emerge here first, and new industries and employment will form and develop here first. It can be said that whoever possesses a world-class science and technology innovation urban agglomeration that serves as a birthplace for future emerging industries will be able to lead future development and shape future patterns.

2 The Yangtze River Delta is Becoming an Important Region for Collaborative Innovation Development in China

From Shanghai' s "Sunday engineers" providing technical support to enterprises in Jiangsu and Zhejiang in the early reform and opening-up period, to the initiatives and explorations of the "Shanghai Economic Zone" in the 1980s, and then to comprehensive cooperation after entering the 21st century, the Yangtze River Delta has a long history of science and technology innovation cooperation.

2.1 The Top-level Framework for Regional Collaborative Innovation in the Yangtze River Delta Continues to Improve

Since 2003, with the signing of the "Agreement on Jointly Promoting the Construction of the Yangtze River Delta Innovation System by Jiangsu, Zhejiang, and Shanghai," science and technology innovation cooperation in the Yangtze River Delta has begun to "accelerate and expand." In 2008, Anhui began participating in Yangtze River Delta science and technology innovation cooperation. The three provinces and one municipality jointly released the "Three-Year Action Plan for Yangtze River Delta Science and Technology Cooperation (2008-2010)" and formally established a rotating chair system for regional innovation system construction joint meetings. In June 2016, the State Council issued the "Yangtze River Delta Urban Agglomeration Development Plan."In the same year, the three provinces and one municipality signed the "Cooperation Framework Agreement on Jointly Promoting the Construction of the Yangtze River Delta Regional Collaborative Innovation Network." In 2017, they jointly researched, formulated, and issued the "Three-Year Action Plan for Yangtze River Delta Regional Collaborative Innovation Network Construction (2018-2020)." In 2018, leveraging the China International Import Expo, the three provinces and one municipality jointly built a technology trade service hub docking platform.

Yangtze River Delta regional innovation cooperation has evolved from the "spontaneous" actions of innovation actors to the "conscious" coordination of the entire region. The continuous promotion of science and technology innovation cooperation among the three provinces and one municipality has not only pioneered regional collaborative innovation in China but has also actively explored the formation of multi-level, multi-channel, and multi-model regional collaborative innovation systems and mechanisms.

2.2 The Yangtze River Delta Has Created a Favorable Situation of Open Sharing of Science and Technology Innovation Resources

With the continuous optimization of commuter networks marked by high-speed rail networks, the process of open sharing of science and technology innovation resources in the Yangtze River Delta region has accelerated.

The Yangtze River Delta has taken the lead in promoting open sharing of large-scale scientific instruments. The three provinces and one municipality jointly launched the "Yangtze River Delta Large-Scale Instruments Network" to promote open sharing of large-scale scientific instrument equipment and R&D resources within the region. By the end of 2017, the network had gathered 27,479 sets of large-scale scientific instruments and facilities from 2,192 units in the region, with a total value exceeding 29.861 billion RMB. Among them, 17,202 sets of instruments and facilities were valued at over 500,000 RMB. These instruments and facilities have provided relatively comprehensive and high-quality testing, identification, and value-added scientific research services for enterprises, universities, and research institutes in the Yangtze River Delta region. For example, in 2017, 366 large-scale instruments from 48 Shanghai units provided 17,870 services to 784 Suzhou enterprises, involving 2,779 samples.

The region has jointly built and shared major research facilities and conducted collaborative research. It has jointly promoted the construction of major scientific and technological infrastructure such as the national "Future Network Testbed," quantum communication "Beijing-Shanghai Trunk Line," and "High-Efficiency Low-Carbon Gas Turbine Test Device," and actively promoted open sharing of established major research facilities such as the National Supercomputing Wuxi Center to the three provinces and one municipality. Joint research projects have been carried out in fields such as public security, livelihood protection, environmental protection, new energy vehicles, electronic information, energy conservation and environmental protection, and advanced manufacturing.

Leveraging the "innovation voucher" policy, the region has actively promoted integrated open sharing of science and technology resources. Suzhou, Wuxi National High-Tech Zone, Suqian in Jiangsu Province, Changxing County, Haining, and Jiaxing in Zhejiang Province have piloted the universal use of "innovation vouchers" with Shanghai, further promoting the healthy flow of science and technology innovation resources within the Yangtze River Delta region. For

example, in Changxing, Zhejiang, application-based innovation vouchers are applicable not only to the Zhejiang Science and Technology Innovation Cloud Service Platform but also to service units affiliated with Shanghai's R&D Public Service Platform and Jiangsu's Large-Scale Scientific Instrument Equipment Sharing Service Platform. The three provinces and one municipality are also actively researching the working mechanism for universal redemption of innovation vouchers. In the future, innovation actors in the Yangtze River Delta will be able to more conveniently achieve optimal matching with the best science and technology innovation resources in the region.

2.3 Various Characteristic Collaborative Innovation Zones Have Begun to Emerge in the Yangtze River Delta

Neighboring cities and regions within the Yangtze River Delta are accelerating their integration to achieve "clustered" development and jointly promote the implementation of the innovation-driven development strategy.

The region is jointly building science and technology innovation corridors along major transportation routes. In 2017, Shanghai's Songjiang District and Zhejiang's Jiaxing and Hangzhou jointly signed the "Strategic Cooperation Agreement on the Construction of the G60 Science and Technology Innovation Corridor."In 2018, the G60 Science and Technology Innovation Corridor was upgraded to version "3.0" involving nine cities across the four regions of Shanghai, Jiangsu, Zhejiang, and Anhui, with Suzhou in Jiangsu, Huzhou, Jinhua in Zhejiang, and Xuancheng, Wuhu, and Hefei in Anhui joining. The formation and expansion of the G60 Science and Technology Innovation Corridor demonstrate that relevant cities (districts) in the Yangtze River Delta have formed strategic consensus on jointly seizing opportunities for innovative development of emerging industries.

Innovation development zones are being jointly built in areas adjacent to administrative boundaries. With the theme of "Connecting with Shanghai and Building the North Gate," Nantong has comprehensively aligned with Shanghai, researching, formulating, and issuing the "Action Plan for Nantong to Connect with Shanghai's Science and Technology Innovation Resources," which has been put into concrete action. The three adjacent administrative districts of Shanghai's Jiading, Suzhou's Kunshan, and Taicang in Jiangsu are jointly promoting the construction and development of the "Jia-Kun-Tai Innovation Zone," achieving positive interaction in Jiading's automotive industry, Kunshan's integrated circuit industry, and Taicang's German enterprise park. Zhejiang Province has designated Jiaxing as an important demonstration area for connecting with Shanghai, and Jiaxing has jointly signed the "Framework Agreement on Deepening Cooperation and Accelerating the Construction of Zhangjiang Yangtze River Delta Science and Technology City" with Shanghai's Zhangjiang and Jinshan, supporting the construction and development of platforms such as the Zhangjiang Pinghu Science and Technology Park and the Zhejiang Shanghai-adjacent Industrial Cooperation Park. The integrated development of these adjacent areas is creating new growth poles.

2.4 Mechanisms and Channels for Smooth Flow of Science and Technology Innovation Elements in the Yangtze River Delta are Increasingly Rich

For a long time, due to geographical proximity, cultural affinity, and compatible industrial supporting systems, the flow of enterprises, talent, and technology has been relatively frequent in the Yangtze River Delta. In recent years, the region has actively promoted accelerated flow of science and technology innovation elements.

The region has jointly promoted technology transfer within the Yangtze River Delta. The three provinces and one municipality jointly signed the "Cooperation Agreement on Jointly Promoting the Construction of the Technology Transfer System in the Yangtze River Delta Region," focusing on cooperation in areas such as integrated development of national scientific and technological achievements transfer and transformation demonstration zones, construction of regional technology transfer collaborative networks, development of technology transfer institutions and talent training, unified service standards, international cooperation, two-way transformation of military and civilian scientific and technological achievements, and construction of the Yangtze River Delta technology trading market alliance, aiming to enhance the overall efficiency of technology transfer.

The region has leveraged the role of technology markets and jointly organized technology trading activities. It has jointly utilized technology transfer and trading platforms such as the National Technology Transfer Eastern Center (Shanghai), National Technology Transfer Southern Jiangsu Center (Suzhou), Zhejiang Science and Technology Market, and Anhui Online Technology Market to build an integrated Yangtze River Delta technology market. The region has also collaborated on major influential events such as the China (Shanghai) International Technology Fair, China Jiangsu International Industry-University-Research Cooperation Achievements Exhibition and Negotiation Conference, Zhejiang Online Technology Market Activity Week, Spring (Autumn) Season Scientific and Technological Achievements Auction, and China International Huishang Conference. In 2018, the first Yangtze River Delta International Innovation Demand Challenge Competition was jointly held.

The region supports the mutual establishment of various new R&D institutions and innovation "enclaves." Many universities and research institutes in the Yangtze River Delta have established a series of industrial technology R&D institutions outside their home locations. For example, Jiangsu has jointly built new R&D institutions such as the Nanjing Advanced Laser Technology Research Institute and Suzhou Industrial Technology Research Institute of Zhejiang University with renowned universities and institutes in the region including Fudan University, Shanghai Jiao Tong University, Zhejiang University, University of Science and Technology of China, and Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences. Many enterprises in the Yangtze

River Delta have also placed their R&D and innovation centers in Shanghai and other cities with dense science and education resources. Central cities such as Shanghai, Nanjing, Hangzhou, and Hefei, which are relatively rich in science and technology innovation resources, are exporting their science and technology innovation resource brands to other cities and regions in the Yangtze River Delta, forming two-way innovation "enclaves."

3 Strategic Considerations for the Yangtze River Delta to Form a World-class Science and Technology Innovation Urban Agglomeration

The Yangtze River Delta is one of China' s most dynamic and powerful regions in terms of socioeconomic and science and technology innovation development. By the end of 2017, the three provinces and one municipality covered 1/26 of the nation' s area, had a population of 220 million (1/6 of the national total), and generated an economic output exceeding 19 trillion RMB (1/4 of the national total). The Yangtze River Delta urban agglomeration with Shanghai at its core is becoming the world' s sixth largest metropolitan circle. In the new era, the integration of the Yangtze River Delta urban agglomeration must reflect the momentum of innovation-driven development and high-quality development.

3.1 Science and Technology Innovation Urban Agglomeration: An Inevitable Choice for Deep Science and Technology Innovation Cooperation in the Yangtze River Delta

Current new trends in Yangtze River Delta science and technology innovation cooperation herald the rise of an important science and technology innovation urban agglomeration. First, moving from one-way support to multi-dimensional collaboration, the multi-directional flow of enterprises within the Yangtze River Delta region is creating new deep cooperation, reflecting the important role of "radiation-trickle effects." The homogenization, integration, and coordination between core cities and node cities are advancing toward a new stage of high-quality development.

Second, moving from point-to-point interaction to cross-boundary integration, an increasing number of provincial border-adjacent areas have begun deep integration, reflecting innovative filling and spatial repair of the "lowland" spaces at former urban edges. Innovation-oriented urban continuous belts based on 60-90 minute high-speed rail and future intercity rapid rail are taking shape.

Third, moving from homogeneous competition to integrated-city cooperation, the appeal of shifting from competing for foreign investment, enterprises, preferential policies, and projects to collaborative innovation development is growing. From reflecting distinctive innovation systems and innovation ecosystems, there is potential to nurture future world-class innovation industry belts.

These new trends indicate that the Yangtze River Delta urban agglomeration has

entered a new stage of science and technology innovation and spatial response, with innovation corridors, innovative urban agglomerations, and innovative urban continuous belts of enormous capacity being nurtured and developed.

3.2 Vision and Goals for the Yangtze River Delta to Form a World-class Science and Technology Innovation Urban Agglomeration

The Yangtze River Delta' s march toward a world-class science and technology innovation urban agglomeration is determined by China' s national conditions and the region' s own development trajectory, aligning with China' s goals of becoming an innovative country by 2020, joining the front ranks of innovative countries by 2030, basically achieving modernization by 2035, and building a world science and technology power and a great modern socialist country by the middle of this century.

By 2035, with Shanghai' s construction of a globally influential science and technology innovation center as the guide, together with cities such as Nanjing, Hangzhou, and Hefei, the Yangtze River Delta will aim at world science and technology frontiers and top-tier levels to jointly build a global science and technology innovation urban agglomeration. The region will continuously optimize an open, inclusive, and shared innovation ecosystem, accelerate the formation of a networked, open, and integrated innovation-driven development pattern, continuously strengthen its scientific and technological innovation capabilities, take the lead in the rise of emerging leading industries, and maintain beautiful urban and suburban ecology. The region will strive to become an important hub of the global innovation network and a crucial birthplace of international science, technology, and industry, taking the lead in joining the front ranks of innovative countries and basically achieving modernization, providing strong innovation support for high-quality development nationwide and better serving the Belt and Road Initiative and the Yangtze River Economic Belt development [1][2].

By the middle of the 21st century, with Shanghai's comprehensive establishment as an excellent global innovation city and a world-influential socialist modern international metropolis as the driver, together with cities such as Nanjing, Hangzhou, and Hefei, the Yangtze River Delta will build a world-class birthplace of science, technology, and industry innovation. It will become a science and technology innovation urban agglomeration with vibrant innovation and entrepreneurship, high density of inter-city science and technology innovation element flow, and strong interconnections worldwide. It will become the world' s most economically dynamic innovation resource allocation center, a science and technology innovation highland with global influence, and a globally important birthplace of industrial innovation, making due contributions to China' s building of a prosperous, strong, democratic, civilized, harmonious, and beautiful socialist modern country and the realization of the Chinese Dream of the great rejuvenation of the Chinese nation [1][2].

3.3 Basic Approach for the Yangtze River Delta to Form a World-class Science and Technology Innovation Urban Agglomeration

As the world's sixth largest urban agglomeration, the Yangtze River Delta urban agglomeration must firmly grasp strategic opportunities presented by the new scientific and technological revolution and industrial transformation, fully leverage its resource endowments such as dense population and good infrastructure, and strive to take the lead in reform and innovation nationwide.

—Use free flow of knowledge to spawn strategic original achievements. With reform as the driving force and opening-up as the condition, the entire Yangtze River Delta should be treated as a special zone for scientific and technological innovation, eliminating obstacles to the free and orderly flow of talent, technology, information, and other elements within the region to the greatest extent possible. Based on clear rights and responsibilities, free and orderly conversion of talent identity should be achieved to create a homogenization effect of knowledge flow. The region should build first-class universities, research institutions, and world-class knowledge infrastructure and functional scientific and technological innovation platforms, enabling scientific and technological innovation talents to create globally influential original achievements in strategic frontier fields of scientific and technological innovation with abundant energy and active thinking [3].

—Achieve large-volume innovation through large-scale spatial response. Various signs shown by the new scientific and technological revolution and industrial transformation indicate that future emerging leading industry clusters will require larger-scale spaces to carry their innovation trials and errors. This requires continued construction and optimization of world-class intelligent and high-speed transportation and information networks within the Yangtze River Delta to promote innovation and entrepreneurship, transfer and transformation of scientific and technological achievements, and industrial application demonstrations. The region must continuously increase the "concentration" of scientific and technological resources, the "abundance" of innovation ecosystems, and the "density" of economic activities, providing sufficient land carrying capacity, ample financial support, and adequate iterative trial-and-error space for the nurturing and formation of future emerging leading industry clusters, making it one of the world' s important birthplaces of future industries.

—Use modern innovation governance to facilitate a modern economic system. The region should give full play to the decisive role of the market, cultivate and form a high-standard and integrated market economy environment, and make enterprises the main actors in innovation decision-making, R&D investment, scientific research organization, achievement transformation, and industrial layout in Yangtze River Delta collaborative innovation. The region should further smooth multi-level dialogue and communication mechanisms among governments at the provincial, municipal, and district/county levels, consolidate in-

tergovernmental science and technology innovation cooperation platforms, and form a large platform for Yangtze River Delta integrated science and technology innovation public services with unified standards, smooth docking, convenient transfer, and mutual recognition and sharing. The region should actively encourage the development of innovation service social organizations, promote the expansion and strengthening of the science and technology service industry based on a unified large market, and provide effective "safety net" support for tolerating failure and incentivizing success through rich innovation-oriented social policies. By building a more effective government, a more orderly market, and a more dynamic society, the region should form a Yangtze River Delta integrated science and technology innovation governance system with multi-level government departments, diverse innovation actors, and multiple social organizations interacting and integrating, supporting the nurturing and improvement of a modern economic system and achieving high-quality development [3][4].

4 Countermeasures and Suggestions for the Yangtze River Delta to Form a World-class Science and Technology Innovation Urban Agglomeration

Centering on the vision and goals and based on the development approach, the region must unswervingly deepen reform, leverage its advantages in open innovation, and accelerate its march toward a world-class science and technology innovation urban agglomeration.

4.1 Implement Forward-looking Innovation Foresight to Form a Dynamically Optimized Original Major Science and Technology Strategy

Leveraging the Yangtze River Delta's fine tradition and solid foundation in technology foresight, and targeting the region's science and technology innovation resource endowments and overall development vision, the region should explore and apply new methods such as big data, knowledge mining, and artificial intelligence to conduct joint rolling scientific outlooks and technology foresight in response to the important impacts brought by the new scientific and technological revolution and industrial transformation. The region should jointly promote the dissemination and application of technology foresight concepts and methods within the region, encouraging various innovation actors to actively apply technology foresight to clarify their own discipline construction, capacity building, and industrial technology innovation directions.

The region should gradually establish a globally oriented "technology radar matrix" to dynamically and timely search for and identify R&D hotspots, competition focal points, and development priorities for disruptive technologies, destructive innovations, and major original breakthroughs in future industries. Based on foresight results, the region should dynamically deploy relevant R&D and innovation strategic tasks. In the near term, in fields such as artificial intelligence, 5G, vehicle networking and intelligent driving, Internet of Things,

industrial Internet, AR/VR, immunotherapy, mobile healthcare, quantum computing and quantum communication, the region should jointly conduct strategic technology roadmaps and industrial technology innovation competition maps at the regional level, and encourage and support relevant industry associations, strategic alliances, enterprises, and research institutions to conduct industrial/product/field technology roadmap research, providing effective support for actively undertaking national major special projects, 2030 special projects, local major special projects, and the innovative development of emerging industries in the Yangtze River Delta.

4.2 Explore Integrated Innovation Planning to Form an Effectively Implemented Top-level Design for Science and Technology Innovation Urban Agglomerations

The region should practice the concept of "multi-plan coordination and functional spatial integration," using scientific and technological innovation as the central axis, socioeconomic development as the goal, and land space as the foundation to match and integrate the three, transferring the driving force of socioeconomic development to scientific and technological innovation and reflecting the realization of scientific and technological innovation functions in spatial layout. The region should implement national strategic plans (Yangtze River Delta regional development plan, urban agglomeration development plan, Yangtze River Economic Belt development plan) into the urban and rural planning of the three provinces and the overall urban planning of Shanghai. In this process, it should take scientific and technological innovation as the core and organically connect with special plans for transportation, energy, information, environmental protection, public services, and industry. The region should improve and optimize metropolitan area transportation networks, build homogenized transportation networks for each metropolitan area, accelerate the construction of metropolitan area intercity railways (regional railways), and gradually connect subway and rail transit lines of various cities. It should strengthen information resource integration, achieve interconnection and sharing of urban agglomeration transportation information, accelerate the construction of next-generation information infrastructure covering the region, radiating to surrounding areas, serving the nation, connecting with the Asia-Pacific, and facing the world, establish a unified geographic information public service platform, promote the application of intelligent technology, take the lead in building a high-quality integrated smart urban agglomeration, and form a powerful infrastructure network supporting scientific and technological innovation [1].

4.3 Nurture a World-class Innovation Ecosystem to Form Diversified Science and Technology Innovation Actors with Global Influence

The region should comprehensively leverage the market' s decisive role in allocating innovation resources, build a world-class innovation service environment and support system for enterprises, universities, research institutes, and science

and technology service institutions. It should deepen market integration, jointly gather and cultivate globally influential root and innovative multinational companies, integrate market access and technical standards, jointly develop science and technology finance, expand and strengthen the Yangtze River Delta venture capital market supporting innovation, and strive to become a globally influential intellectual property trading center and innovation resource allocation center. The region should increase research sharing, promote the clustering, grouping, and intensive development of research facilities, jointly build world-class comprehensive science centers, and develop more world-class universities and research institutes. It should promote service internationalization, promote open innovation, cultivate and gather a large number of node-type, hub-type, and functional innovation service institutions linking to the global innovation network, making the Yangtze River Delta an important carrier for China' s expanded opening-up and participation in global competition in the R&D and innovation field. The region should accelerate ecological diversification, encourage cities to give full play to their own advantages and characteristic resource endowments in collaboration and competition, nurture and develop distinctive innovation ecosystems, and actively explore new models, new business forms, and new types of R&D organizations, building a world-class innovation ecosystem for the emergence of world-class innovative economies.

4.4 Build International Innovation Platforms to Form Multi-level Science and Technology Innovation Talent Leading the Future

The region should create a Yangtze River Delta "talent special zone," fully stimulate the vitality and dynamism of innovation and entrepreneurship throughout society, and cultivate a large number of entrepreneurs, scientists, engineers, craftsmen, and science and technology service talents. Nurturing science and technology innovation talents requires "breadth" —establishing the concept that everyone aspires to become talented, creating an atmosphere where everyone strives to become talented, constructing mechanisms where everyone can become talented, and forming an environment where everyone can fully display their talents. Cultivating science and technology innovation talents requires "magnanimity" —setting up major science and technology projects targeting human destiny, serving national and Yangtze River Delta major strategies, and solving major scientific problems, enabling science and technology innovation talents to grow and achieve great accomplishments in solving major challenges. Gathering science and technology innovation talents requires "abundance" —providing high-intensity investment, abundant resources, and high-degree-of-freedom mechanisms, promoting multi-disciplinary cross-fertilization, multi-category convergence, and multi-actor docking, building world-class frontier exchange platforms and mechanisms, and forming an excellent innovation ecosystem. Motivating science and technology innovation talents requires "precision" —promoting the orderly free flow of various science and technology innovation talents and the orderly free conversion of their identities, exploring the most suitable systems and mechanisms for innovation. Achieving greatness for

science and technology innovation talents requires "height" —establishing innovation self-confidence, breaking the benchmarking and following-type thinking inertia formed by long-term "catching up," encouraging and supporting science and technology innovation talents to persistently carry out research and industrialization work, and producing major achievements that lead the future [5].

4.5 Continuously Promote Reform and Opening-up to Continuously Optimize the Science and Technology Innovation Policy System

The region should promote collaborative science and technology innovation governance among governments at all levels, promote the development and upgrading of various science and technology innovation alliances and cooperation platforms with industry characteristics, professional fields, and comprehensive service nature, and optimize and strengthen the Yangtze River Delta regional innovation system. Leveraging the Yangtze River Delta's export-oriented economy advantages and aiming at international benchmarks, the region should deepen reform and opening-up in pilot free trade zones, accelerate the transformation of government functions, continuously optimize the international business environment, actively explore the implementation of pre-establishment national treatment plus negative list management models, promote fair competition among all enterprises, strengthen early warning, research, and response to technical trade barriers, continuously improve the technical trade measures system, and continuously explore and form replicable and promotable pilot experiences to achieve full coverage in the Yangtze River Delta urban agglomeration first [1]. The region should build a military-civilian integration service innovation platform to promote two-way transfer and transformation of advanced technologies. It should explore legislation for the Yangtze River Delta science and technology innovation urban agglomeration, and under central and national guidance and support, jointly conduct regional and local legislative research and formulation work among the three provinces and one municipality regarding global science and technology innovation centers, new types of legal person organizations, tax-sharing systems, medium-term budgets, industrial technology research and development organizations, and technology market integration, forming a solid legal guarantee foundation. In terms of intellectual property protection, expansion of high-tech imports, and promotion of open innovation, the Yangtze River Delta urban agglomeration should enhance innovation coordination, further strengthen international benchmarking and alignment, and make the entire science and technology innovation policy system more international, forward-looking, and targeted, striving to become the forefront of China' s innovation-driven development and reform and opening-up.

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Author Contributions

Li Wan: Topic selection and design, framework setting, drafting and revision;
Zhou Xiaoling: Field research, viewpoint refinement;
Hu Shuhong: Data compilation, article improvement;
Zhang Renkai: Structural optimization, viewpoint extraction.

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