t. XXX, nr 12/2023 DOI 10.33226/1231-7853.2023.12.3

Prof. Li Dan
Northeastern University in Shenyang, Liaoning (China)
e-mail: lidanneu@mail.neu.edu.cn

Bai Yihan
Northeastern University in Shenyang, Liaoning (China)
e-mail: Baiyh0610@126.com

The source of innovation: How the technology and innovation centre accelerates regional innovation capacity?[1]

Źródło innowacji – jak centrum technologii i innowacji wzmacnia regionalny potencjał innowacyjny?

Abstract

Fostering technology and innovation centres (TIC) is expanding globally; as a result, the concept of the capacity to be the source of innovation (CSI) is getting widespread attention. Four categories of CSI exist: CSI in knowledge, technology, industry, and system. The future development direction of China's TIC is examined by summarizing and contrasting the similarities and differences between three international TICs (Shanghai, Beijing, and Guangdong) and three regional TICs (Zhejiang, Hubei, and Liaoning) in China, in terms of policy texts, development positioning, and regional planning. All of that is done in order to investigate the relationship between the building of TIC and CSI. Additionally, based on the four different types of CSI, the corresponding improvement solutions are given.

Keywords
technology and innovation centre, regional innovation capacity, source of innovation

Streszczenie

Wzmacnianie roli centrów technologii i innowacji (*technology and innovation centres* – TIC) jest obserwowane na całym świecie. W efekcie coraz większe zainteresowanie wzbudza koncepcja zdolności do bycia źródłem innowacji (*capacity to be the source of innovation* – CSI). Istnieją cztery kategorie CSI – w zakresie wiedzy, technologii, przemysłu i systemu. Autorzy badają przyszły kierunek rozwoju chińskich TIC poprzez podsumowanie i zestawienie podobieństw i różnic pomiędzy trzema międzynarodowymi TIC (w Szanghaju, Pekinie i Guangdongu) i trzema regionalnymi TIC (w Zhejiangu, Hubei i Liaoningu) w Chinach, w kontekście polityki, pozycjonowania rozwoju i planowania regionalnego. Celem studium jest zbadanie związku pomiędzy tworzeniem TIC i CSI. Ponadto, opierając się na czterech różnych typach CSI, podano odpowiednie rozwiązania usprawniające.

Słowa kluczowe
centrum technologii i innowacji, regionalny potencjał innowacyjny, źródło innowacji

JEL: M31, D1, D9, B5, E

Introduction

As the world enters the knowledge economy era, China has successfully joined innovative countries through continuous efforts. Innovation is the primary driver of development. Building a globally influential science and technology innovation centres is important for strengthening source innovation capabilities and regional core competitiveness. However, the process of construction of China's science and technology innovation centres is still in early stages. A gap remains, compared to world-class innovative regions, in terms of basic research, core technologies, industrial agglomeration and innovation ecology optimization. This paper aims to put forward universal countermeasures and suggestions for nationwide development and construction, from the perspective of innovation policy to reference China's building of international and regional science and technology innovation centres and enhancing regional innovation capabilities.

Literature review

Innovation arises from knowledge creation and is fuelled by market dynamics. It leverages knowledge application and technology development to drive its innovative prowess (Kline & Rosenberg, 2009). Innovation is widely acknowledged as a fundamental driver of economic growth (Huergo, 2006). In the knowledge economy era, knowledge assumes a central role in both the generation and sustenance of innovation, playing a crucial role in predicting enterprises' long-term survival and fostering regional economic development (Uklov et al., 2016). Innovation capability, as defined by Szeto and Elson (2000), refers to the continuous enhancement of enterprise resources and capacities to explore and develop new products that meet market demands (Szeto, 2000). From an enterprise perspective, innovation capability is typically associated with formal R&D activities and the output of novel products (Kirner et al., 2009). According to Kirner et al. (2009), innovation capability can be broadly categorized into national and regional innovation capability. National innovation capability is considered a crucial factor in driving economic development (Fagerberg & Srholec, 2008). It represents a country's institutional framework and supportive systems for sustainable innovation activities (Hu & Mathews, 2005). Furman et al. (2002) propose that the development of national innovation capability relies on several factors, including the establishment of robust co-innovation infrastructure, the presence of specialized innovation environments within national industrial clusters, and the strength of connections between co-innovation infrastructure and specific clusters. On the other hand, regional innovation capability (RIS) is closely associated with the concept of a regional innovation system. RIS refers to a network of production enterprises, research institutions, and higher education institutions that are geographically interconnected and related (Cooke, 1992). As a collective of networks between public and private institutions, RIS interacts and reciprocates within specific domains, utilizing its infrastructure to adapt, generate, and expand knowledge and innovation (Yam et al., 2011). In the context of the regional innovation ecosystem, Zhao et al. (2013) argue that effective interactions among universities, research institutions, enterprises, government, and intermediaries play crucial role in fostering regional innovation capability. Development of regional innovation capability requires both external influences and internal resources (Binz & Truffer, 2017). Regional innovation diffusion is a complex and comprehensive process influenced by various factors, including innovation capability and spatial proximity among innovation actors (Paci & Usai, 1999). The innovation process within a regional system is considered fundamental in driving economic development, as innovation transformation can only happen when the necessary and sufficient conditions for innovation are in place (Troshin et al., 2014).

In recent years in academic research there has been a growing emphasis on the role of knowledge network elements as a source of innovation strategies. Franceschinis et al. (2017) highlight the significance of knowledge network elements in expanding organizational boundaries during the structural deceleration process in high-tech industries. In contrast to the innovation capability, which focuses on the ability of innovation actors to utilize innovation resources for innovation activities, Rosenberg ((Ed.), 2009) argues that the source capability of innovation policy places greater importance on knowledge creation for innovation. It emphasizes the continuous supplementation of new knowledge through basic research to offset the diminishing marginal benefits of knowledge application. The source capability of scientific and technological innovation, on the other hand, centres around the originality and proactiveness of innovation, primarily through the utilization of external information resources and collaboration among innovation actors (Yam et al., 2011).

In recent years, with the continuous improvement of the concept of strengthening the source of innovation policy, the science and technology innovation centre, with the main construction goal of improving the source of innovation policy, has increasingly become one of the focuses of academic inquiry. Yuasa (1962) believes that a quantitative indicator for a country to be called a "world scientific activity centre" lies in whether the number of scientific achievements over a certain period exceeds 25% of the total number of scientific achievements in the world, while Gerlach and Brem (2015) reckon that the word innovation hub is similar to business incubator. Therefore, it can be said that the Science and Technology Innovation Centre can not only become a place for product development and design (Berger & Brem, 2017), but can also become a catalyst for regional economic development or revitalization, and improve regional economic quality (Bruneel et al., 2010). The Science and Technology Innovation Centre often takes the form of a collaborative workspace, offering a range of services, including community building, pre-incubation, incubation, and acceleration programs (Jiménez et al., 2018). It serves as a spatial hub where various innovation actors come together, and the knowledge and technology spillover effects foster the emergence of innovation activities within cities (Bozdogan et al., 1998). The Science and Technology Innovation Centre is not merely a single location, but rather a network of interdependent regions within it, formed through the exchange of innovation elements and through diffusion of knowledge (Filatotchev et al., 2011). It exhibits characteristics such as functional dominance, structural hierarchy, spatial aggregation, focus on high-end industries, and cultural inclusiveness. (Ritala et al., 2015). Science and technology innovation centres undertake functions such as source innovation, agglomeration effects, radiation effects, and leading innovation (Su, 2019). The spatial structure of science and technology innovation centres is constructed through innovative activities, such as knowledge diffusion, spillover, and the flow of innovation elements (Filatotchev et al., 2011). The relationship among the three crucial innovation elements in science and technology innovation centres, namely scientific research, education, and industry, demonstrates that the development of a science city (or science and technology innovation centre) is conducive to attracting investments, promoting business development, and contributing to the advancement of the national innovation system (Akinfeeva & Abramov, 2015). Therefore, the key to constructing science and technology innovation centres lies in fostering strong linkages among universities, enterprises, and governments (Sohn & Kenney, 2007). Furthermore, Zhang (2019) suggests that the construction of science and technology innovation centres can be evaluated using an index system that encompasses four aspects: innovation resources, innovation investment, innovation achievements, and innovation carriers. The transfer of the World Science and Technology Innovation Centre across different stages is driven by significant changes, such as technological advancements and industrial agglomeration (Wu et al., 2020). This transfer phenomenon is primarily rooted in the dynamic nature of innovation, characterized by the diversity of innovation over time and space. Over time, the innovation centre may shift from one department, region, or country to another (Clark et al., 2002).

Capacity to be the source of innovation

The capacity to be the source of innovation (CSI) is an important part of scientific and technological innovation core capacity, playing vital role in improving innovation ability effectively. Therefore, this paper defines the innovation policy source as taking improving original innovation level and technological innovation energy level as main tasks, with original innovation initiative and breakthrough as main characteristics. From the content perspective, innovation policy source can be divided into knowledge, technology, industry and system policy sources (Table 1).

CSI in knowledge

CSI in knowledge is an innovative source that takes universities and state key labs as main carriers. It promotes a country's original breakthrough in basic research through human and financial investment, then takes a leading position in academic and discipline construction. Improving knowledge strategy sources relies on original breakthroughs in basic research, the source of all innovation and development, and an important cornerstone for technological break-throughs and developing innovation capacity. Knowledge strategy focuses on research originality and scientific value evaluation to provide academic accumulation and cultural preparation for innovation strategy promotion.

CSI in technology

CSI in technology is an innovative source ability that takes national technology research centres and leading science/technology enterprises as main carriers. It promotes breakthroughs in key core technologies and "stuck neck" technologies through human and financial investment in technology R&D. Improving technology policy sources relies on enhancing core technology competitiveness and promoting key technology research. The purpose is to provide stable technical support for open innovation ecosystem formation by establishing platforms for S&T enterprise and international technology exchange, and integrating innovation with market demand.

CSI in industry

CSI in industry is an innovative source ability that takes high-tech enterprises and innovation demonstration zones as main carriers. It promotes breakthroughs in improving industrial ecology and optimizing spatial layout by cultivating strategic emerging industries and forming industrial clusters in key areas. The purpose is to improve global industrial competitiveness by improving industrial structure and promoting agglomeration, which significantly promotes national comprehensive competitiveness.

CSI in System

CSI in system is an innovative source ability that takes the government science and technology department as main carrier. It promotes forming a good environment for innovation and entrepreneurship by improving policies in scientific talent incentives, tax incentives and subsidies, investment and financing.

The capacity aims to promote reform of the innovation system/mechanism, enhance national innovation mechanism exploration ability and top-level system design, providing strong institutional support for developing a powerful innovation country. This capacity has very close connection with the general administrative ability of the government.

Table 1. Four aspects of innovation strategy

Type	Core elements	Prerequisites	Indicators	Effects
CSI in knowledge	Basic research, educational and scientific research institutions, first-class discipline construction and academic achievements	Increase investment in basic research fields, encourage discipline construction and improve scientific research ability	R&D input and expenditure in basic research field, the number of scientific research personnel, the number of state key laboratories, and the number of academic papers published	With a high level of original innovation, and constantly achieving innovative breakthroughs in frontier disciplines
CSI in technology	Key core technology, "card neck" technology	Improve the competitiveness of key core technologies, promote core technology research in key areas, and create new kinetic energy for the high-quality development of science and technology innovation industries	The number of high-tech enterprises, the turnover of technology contracts, the ratio of R&D expenditure in applied research field to GDP and the number of high-value invention patents	With the continuous development of applied scientific research, the technological innovation level and original innovation production efficiency have been significantly improved, and the applicability of economic and social development has been enhanced
CSI in industry	Industrial agglomeration, enterprise cluster, strategic emerging industries and pillar industries in key areas	A relatively complete industrial chain is formed around leading industries and characteristic industries, and the agglomeration degree of scientific and technological enterprises is improved, forming a new model of regional innovation and development	The number of innovative cooperative industrial projects, the number of high-tech parks, the coverage rate of transportation infrastructure, and the direct investment attracted by industries	Continue to enhance the driving force of industrial development, optimize, adjust and upgrade the industrial structure in terms of personnel, capital and technology, promote scientific and technological enterprises to form regional collaborative innovation, and build a stable industrial ecosystem
CSI in system	Overall planning ability, collaborative innovation ability and exploration ability of innovation demonstration of scientific and technological innovation	Deepening the reform of scientific and technological innovation system and mechanism	Preferential tax policies for science and technology enterprises, government investment and financing system regulations, number of innovation and entrepreneurship incubation platforms, and number of supporting policies	Provide strong policy guarantee for the development of knowledge, technology and industrial policy resources; escort the national scientific and technological innovation and the promotion of comprehensive national strength

Source: own elaboration.

t. XXX, nr 12/2023 DOI 10.33226/1231-7853.2023.12.3

CSI in typical regional innovation centres in China

In 2021 China's "14th Five-Year Plan" and 2035 vision aim to support Beijing, Shanghai, Guangdong–Hong Kong–Macau Greater Bay Area to form international S&T innovation centres, and build comprehensive national science centres in Zhangjiang, Hefei, Huairou and GBA, supporting qualified places to develop regional TICs. By analysing development measures across provinces/cities and taking the four innovation policy sources as direction, this paper provides a basis for putting forward universal policy suggestions on construction of TICs in China.

Comparisons of technology and innovation centre on CSI in knowledge

Knowledge strategy provides scientific research support for each region to enhance its original innovation ability and establish a science and technology innovation centre. In this part, this paper lists the measures taken by the six regions listed as the research objects in terms of knowledge policy resources as shown in Table 2.

Table 2. CSI in knowledge

Region	CSI in knowledge
Shanghai	Accelerate the building of high-level basic research strength: improve the scientific research base system, build high-level research institutions, and strengthen the supporting strength of basic scientific research conditions. Deepen the construction of innovation ability in colleges and universities: optimize the layout and construction of disciplines, promote high-quality collaborative innovation, and cultivate top-notch innovative talents.
Beijing	The regions aim to strengthen strategic scientific and technological strength and improve innovation system efficiency by building a national laboratory system, developing world-class R&D institutions, leveraging high-level universities as the main force for basic research. The regions aim to support original basic research by strengthening basic research systems, developing cutting-edge science and interdisciplinary centres, and improving investment mechanisms for diverse basic research problems.
Guangdong Province	Strengthen the deep integration of production, education and research: support GBA enterprises, universities and research institutes to build a high-level collaborative innovation platform and promote the transformation of scientific and technological achievements. Focus on improving the level of basic research: accelerate the construction of major scientific and technological infrastructure, cross-research platform and frontier disciplines, and expand the implementation of major national scientific and technological projects.
Zhejiang Province	Strengthen the design of basic research system: improve the discipline layout, promote the balanced and coordinated development of basic disciplines and applied disciplines, encourage interdisciplinary research, give more inclination to basic disciplines. Improve the laboratory system: Build a laboratory system with obvious characteristics and advantages, which is composed of national laboratories, state key laboratories, Zhejiang laboratories and provincial key laboratories.
Hubei Province	Hubei aims to accelerate construction and development of State Key Laboratories by fully leveraging the supporting role of innovation institutions like State Key Labs in the province. The regions aim to establish a sustained investment mechanism for basic research. It also focuses on cross-cutting frontier fields of the future regarding network, AI and biological breeding.
Liaoning Province	Strengthen the source supply of scientific and technological innovation: speed up the construction of "double first-class" in colleges and universities and strengthen basic research. Accelerate the construction of a major platform for scientific and technological innovation: build Liaoning laboratories with high standards, strengthen the construction of key laboratories, and strengthen the construction of technological innovation platforms.

Source: own elaboration.

Comparisons of technology and innovation centre on CSI in technology

One of the strategic goals in the construction of science and technology innovation centre is to support a country in achieving major breakthroughs in key core technologies and "stuck neck" technologies. Therefore, improving CSI has become one of the important means and goals for developing scientific and technological innovation in various regions. In terms of technical policy resources, provinces and cities have also issued corresponding development strategies, as shown in Table 3.

Comparisons of technology and innovation centre on CSI in industry

Forming industrial agglomerations in key areas, promoting industrial optimization and upgrading, and enhancing the competitiveness and influence of science and technology innovation centres is an important way to improve regional innovation capabilities. The measures to develop industrial policy resources in various regions are shown in Table 4, in which forming a good location plan and vigorously developing infrastructure construction have become the common goals of the development of science and technology innovation centres.

Table 3. CSI in technology

Region	CSI in technology
Shanghai	Accelerate key technology research in three key areas: focus on key areas, such as integrated circuits, bio-medicine and artificial intelligence, and accelerate towards the high end of global innovation chain, industrial chain and value chain. Strengthen strategic frontier technology breakthroughs: including 6G, block-chain technology, intelligent bionics, etc., to adapt to the trend of industrial change, deploy strategic frontier technologies, and provide support for future industrial cultivation and expansion.
Beijing	Strengthen original leading technology research: promote cutting-edge technologies in key areas, such as artificial intelligence and quantum information, and promote the layout of other cutting-edge fields, such as biological breeding. Aiming at the important concerns of the national economy and people's livelihood: significant achievements have been made in key technologies in the fields of medicine and health, science and technology against epidemic diseases, etc.
Guangdong Province	Strengthen the "chain innovation" of key core technologies: focus on the fields of electronic information, bio-medicine and equipment manufacturing, sort out the shortcomings, weak links and subdivisions of key core technologies in the upstream and downstream of the industrial chain, and form a road map for complementing shortcomings and a list of forging long boards.
Zhejiang Province	Form landmark achievements: overcome the "stuck neck" technology in key industrial clusters, landmark industrial chains and subdivided key technical fields, produce major landmark achievements, and form import substitution capabilities. The regions aim to strengthen research of key core technologies by adhering to inventory promotion and leading applied research with basic research.
Hubei Province	Jiangsu aims to accelerate construction of world-class optoelectronic information technology innovation highlands covering optical communication, lasers and integrated circuits. It seeks to proactively seize strategic heights of digital technology. Accelerate scientific and technological research on life and health: accelerate key technical research on prevention and treatment of major diseases and population health, strengthen high-end guidance in research and development of biomedical technology, and strengthen technical support for public safety and social governance.
Liaoning Province	Fujian aims to accelerate construction of a major S&T innovation platform. This includes benchmarking against the national laboratory model to create a comprehensive platform capable of producing major original achievements, overcoming key core technologies, and leading industrial innovation and development. Guangdong aims to focus efforts on key core technologies. This includes deploying innovation chains around industrial chains to transform and upgrade "old brands", deeply develop "original brands", and cultivate and expand "new brands".

Source: own elaboration.

t. XXX, nr 12/2023 DOI 10.33226/1231-7853.2023.12.3

Table 4. CSI in industry

Region	CSI in industry
Shanghai	Location planning: "One Heart, One City and Many Parks"[a]. Infrastructure construction: Shanghai light source, hard X-ray free electron laser device and other major scientific and technological infrastructure were laid out. Forming the largest photon major scientific and technological infrastructure cluster with the most comprehensive types and the strongest comprehensive capability in the world.
Beijing	Location planning: "Three Cities and One District"[b]. Infrastructure construction: build an integrated circuit test line platform, deploy a "super-large-scale artificial intelligence model training platform", build a trusted digital infrastructure platform based on block-chain, and build a big data platform of "China's Million Slow Patient Queue". Beijing aims to focus on integrating the "three chains" of innovation, industrial and supply chains. It seeks to accelerate cultivation of new momentum in high-tech industries by supporting leading development of "dual engine" industries and innovative development of "advanced intellectual manufacturing" industries.
Guangdong Province	Location planning: "One Core, One Belt and One Area"[c]. Infrastructure construction: build a modern comprehensive transportation system, optimize and upgrade information infrastructure, and improve water conservancy infrastructure. Open to Hong Kong and Macao, the major scientific research infrastructure and large-scale scientific research instruments built and laid out by the state in Guangdong in an orderly manner.
Zhejiang Province	Focus on key areas: on refining and chemical integration, and key advantageous industrial clusters, such as new materials, automobiles and parts, digital security, and landmark industrial chains, such as integrated circuits, bio-medicine and modern textiles. Guangdong aims to support construction of innovative industrial clusters by strengthening deep integration of tech innovation centres with national independent innovation zones, S&T innovation corridors, national/provincial high-tech zones, and new industrial platforms of "10,000 mu and 100 billion yuan".
Hubei Province	Location planning: East Lake Science City will build "one district and three centres"[d], which will become the core supporting force for Hubei to build a strong province of science and technology, and enable China to build a major science centre in the world.Vigorously develop scientific and technological enterprises. In 2021, there will be a net increase of more than 2,200 high-tech enterprises and 758 new gazelle enterprises, and the added value of high-tech industries will increase to about 26%.
Liaoning Province	Location planning: "Shenda Dual Core"[e] promotes scientific and technological economic and trade cooperation with Russia, Mongolia, etc., making Liaoning a gathering area of innovative resources, a hub area for interconnection and a hot spot for development and opening up. Liaoning aims to vigorously develop small and medium-sized scientific and technological enterprises. This includes building a cascade cultivation system of "SMEs-high-tech enterprises-leading S&T enterprises".

Notes: *a* – Zhangjiang Comprehensive National Science Centre, Zhangjiang Science City and Zhangjiang Independent Innovation Demonstration Zone); *b* – Zhongguancun Science City, Huairou Science City, Future Science City, Beijing Economic and Technological Development Zone; *c* – Pearl River Delta Region, Coastal Economic Belt and Northern Ecological Development Zone; *d* – The core bearing area of East Lake Comprehensive National Science Centre, the Global Optoelectronic Information Technology Innovation Centre, the Global Life and Health Industry Innovation Centre, and the Global Carbon Neutral Engineering Science and Technology Innovation Centre; *e* – Shenyang-Dalian National Independent Innovation Demonstration Zone.

Source: own elaboration.

Comparisons of technology and innovation centre on CSI in system

The core of constructing science and technology innovation centres is to enhance the core competitiveness of cities and improve people's well-being. The measures of institutional policy resources in various regions are shown in Table 5. In summary, key focuses shared across regional plans involve talent cultivation and mobility mechanisms, regional cooperation frameworks, innovation environment development, and IP protection.

Table 5. CSI in system

Region	CSI in system
Shanghai	Support Shanghai to carry out comprehensive innovation reform experiments around government innovation management, transfer and transformation of scientific and technological achievements, income distribution, innovation investment, talent development and open cooperation. Create an open and collaborative innovation space: open up a new situation of domestic scientific and technological cooperation, lead the integrated development of the Yangtze River Delta, and build a high-level international innovation network.
Beijing	Accelerate the construction of Zhongguancun National Independent Innovation Demonstration Zone: protect and stimulate the innovation vitality of small and medium-sized enterprises and build a perfect innovation and entrepreneurship service system. Accelerate the construction of an important talent centre and innovation highland in the world: enhance the attraction of international talents, intensify the training of innovative talents.
Guangdong Province	Strengthen cooperation in scientific and technological innovation: promote the construction of "Guangzhou-Shenzhen-Hong Kong-Macao" scientific and technological innovation corridor, and jointly build a big data centre and an international innovation platform in GBA. Improve the innovation and entrepreneurship mechanism: Support Guangdong Province to establish an innovation and entrepreneurship exchange mechanism with Hong Kong and Macao, share innovation and entrepreneurship resources, and jointly improve the innovation and entrepreneurship ecology.
Zhejiang Province	Establish a scientific evaluation mechanism: explore the establishment of a scientific evaluation mechanism that combines short-term with medium-and long-term, is conducive to stimulating the innovation vitality of scientific researchers, and conforms to the laws of scientific research activities. Improve the policy system: strengthen policy support in science and technology, finance, education, land, taxation, talents and finance.
Hubei Province	Organization of scientific research projects, management of scientific research funds, reform of scientific research institutions, evaluation and reward systems for science and technology, transformation of scientific and technological achievements, supervision of scientific research integrity. S&T innovation has become an important driving force for the province to build a new development model centred around services. An effective cooperation mechanism has also been established with major innovative countries worldwide and countries along the Belt and Road Initiative.
Liaoning Province	Deepen the reform of science and technology system and mechanism: take the transformation of government functions as an important task of science and technology reform, promote the reform of incentive mechanism for science and technology evaluation. Create an excellent innovation ecology: strengthen the protection of intellectual property rights, promote the innovation of technical standards, carry forward the spirit of scientists in the new era, strengthen the construction of scientific research integrity, and promote the popularization of science and technology.

Source: own elaboration.

Conclusion

By analysing existing measures, strategic plans, economic/industrial factors, and functional orientations of international and regional S&T innovation centres in China, this paper finds differences in how centres are constructed across regions. However, the development plans of each centre are generally consistent in strengthening the policy source function (CSI) as the main goal. Based on comparing centres' characteristics, suggestions are made from the perspective of strengthening the four forms of innovation policy source defined earlier.

CSI in knowledge: Promoting the capacity of original innovation

The promotion of knowledge policy means paying attention to the original innovation ability and focusing on grasping the development trend of academic and scientific innovation. In this regard, this paper puts forward the following development suggestions:

t. XXX, nr 12/2023 DOI 10.33226/1231-7853.2023.12.3

On the one hand, it is necessary to build and strengthen the national strategic scientific and technological strength with state key laboratories, national scientific and technological research and development institutions and high-level universities as important components. Increase investment in state key laboratories and clarify their functional roles. Focus on strengthening R&D of cutting-edge technologies. Also, empower research personnel, optimize disciplines and evaluations, and cultivate original talents for innovation centre construction.

On the other hand, we should vigorously develop basic research and carry out source innovation. Innovate channels for enterprises to engage in basic research. Increase spending on basic research and expand its proportion of total R&D spending in society. Strengthen industry-university cooperation via special industrial basic research funds to guide enterprise participation in basic research projects and increase capital investment in basic research with a goal of 8% of total R&D spending.

CSI in technology: Increase the capacity of technical innovation

Improving tech policy means focusing on energy levels of innovation, increasing key tech research in key areas, and breaking through "stuck neck" core technologies. Tech policy is the focus of STI centre development plans and provides strong tech support for boosting regional innovation capability. The following development suggestions are provided:

On the one hand, it is necessary to build a leading enterprise in science and technology and increase the national strategic scientific and technological strength. Integrate other innovation ecosystem players like universities and research institutions to form effective coupling. Actively utilize spillovers between enterprises by opening/sharing S&T facilities platforms, data, and tech verification environments for small and medium-sized enterprises (SMEs).

On the other hand, it is necessary to achieve major breakthroughs in key core technologies. Based on tech policy evaluation indexes, establish an achievement transformation mechanism oriented toward demand. Improve construction of tech achievement trading evaluation platforms and achievement transformation efficiency sharing S&T service platforms to enhance matching with market demand.

CSI in industry: Enhance the driving force of industrial development

The promotion of industrial policy pays attention to driving industry development, supporting and leading key industries. It cultivates pillar and emerging industries but also inherits traditional regional bases, promoting optimization and upgrading. The following development suggestions are provided:

First of all, form industrial clusters in key areas, focusing on the regional high-tech industry's key development directions. Establish science and technology parks to promote industrial development. The planning and construction of science and technology innovation centres should focus on leading and characteristic industries based on resource advantages. Attract investment through industrial chain investment and seek common development.

Then, form enterprise clusters in science and technology parks, and increase investment in innovative infrastructure construction. First, speed up the agglomeration of science and technology enterprises. Intensify efforts to support SMEs, gazelles and unicorns, and establish a whole-process tracking service mechanism, from initial to growth and development stages. Second, give play to the integration role of infrastructure clusters in science and technology parks and accelerate construction of new infrastructure layouts such as 5G, data centres and super-computing centres.

Furthermore, vigorously develop the construction of urban agglomerations and optimize urban spatial layout. Establish a new model where central cities lead urban agglomeration development and agglomerations drive regional development. The industrial synergy system of each urban agglomeration should develop in the direction of multi-centred, net-worked and innovation-driven.

CSI in system: Implementation institutional reforms

The promotion of institutional policy means deepening reform of China's institutional mechanism. This involves enhancing overall planning ability for scientific and technological innovation, building a more dynamic innovation ecology, and promoting modernization of the innovation governance system and governance capacity. Based on this, this paper puts forward the following development suggestions for the promotion of institutional policy source:

First, improve the fiscal and taxation policies and innovation and entrepreneurship policies, and provide institutional support for building science and technology innovation centres and science and technology parks. For fiscal and tax policies, the government should increase financial subsidies and tax incentives for small and medium-sized enterprises and young eagle gazelle unicorn enterprises, provide them with special funds for innovation and development. Second, continuously improve and promote the enterprise innovation points system, which allows the government to develop precise policies, and promotes precise efforts from financial institutions. Optimize entrepreneurial environment and talent incentive system, avoiding worries of scientific personnel by providing housing subsidies.

Second, create a collaborative innovation mechanism within the Science and Technology Innovation Centre. On the one hand, enhance the active cooperation between regional scientific research institutions in carrying out scientific research and development and production experiments in R&D incubation. On the other hand, it is necessary to build a high-level domestic and international innovation network. For provinces and cities that build regional science and technology innovation centres, put forward a clear development direction for the construction of TIC, and then promote the construction of regional innovation system.

Third, speed up the construction of incubation system for scientific and technological achievements. The government should build more state-level science and technology business incubators, promote the integration of schools and places, support domestic colleges and universities to cooperate with internationally renowned universities to organize relevant science and technology service institutions, and provide platform convenience for the incubation of scientific and technological achievements.

The paper examines the construction of science and technology innovation centres from the perspective of promoting institutional policy sources. It combs and compares international and regional innovation centres in terms of policies, measures, development strategies and regional positioning. It explores the relationship between building innovation centres and promoting regional innovation capability from four aspects: knowledge, technology, industry and institutional policy source. The key aspects covered include comparisons of innovation centres, relationship to regional innovation capability, broad suggestions, and note that localized countermeasures are still needed.

Notes/Przypisy

[1] This research was supported by the Planning Project of Philosophy and Social Sciences in Shenyang (2023), grant number SY20230115Z. We would like to show gratitude for their research funding support.

References/Bibliografia

Akinfeeva, E. V., & Abramov, V. I. (2015). The role of science cities in the development of the national innovation system in Russia. *Studies on Russian Economic Development*, *26*, 91–99. https://doi.org/10.1134/S1075700715010025

Berger, A., & Brem, A. (2017). Why do European companies have innovation hubs in Silicon Valley – Best practice examples and key takeaways. *Thunderbird International Business Review*, *59*(6), 757–763. https://doi.org/10.1002/tie.21884

Binz, C., & Truffer, B. (2017). Global Innovation Systems – A conceptual framework for innovation dynamics in transnational contexts. *Research Policy*, *46*(7), 1284–1298. https://doi.org/10.1016/j.respol.2017.05.012

Bozdogan, K., Deyst, J., Hoult, D., & Lucas, M. (1998). Architectural innovation in product development through early supplier integration. *R&D Management*, 28(3), 163–173. https://doi.org/10.1111/1467-9310.00093

Bruneel, J., d'Este, P., & Salter, A. (2010). Investigating the factors that diminish the barriers to university–industry collaboration. *Research Policy*, *39*(7), 858–868. https://doi.org/10.1016/j.respol.2010.03.006

Clark, G. L., Feldman, M. P., Gertler, M. S., & Williams, K. (Eds.). (2003). *The Oxford handbook of economic geography*. Oxford University Press.

Cooke, P. (1992). Regional innovation systems: Competitive regulation in the new Europe. *Geoforum*, *23*(3), 365–382. https://doi.org/10.1016/0016-7185(92)90048-9

Fagerberg, J., & Srholec, M. (2008). National innovation systems, capabilities and economic development. *Research Policy*, *37*(9), 1417–1435. https://doi.org/10.1016/j.respol.2008.06.003

Filatotchev, I., Liu, X., Lu, J., & Wright, M. (2011). Knowledge spillovers through human mobility across national borders: Evidence from Zhongguancun Science Park in China. *Research Policy*, *40*(3), 453–462. https://doi.org/10.1016/j.respol.2011.01.003

Franceschinis, C., Thiene, M., Scarpa, R., Rose, J., Moretto, M., & Cavalli, R. (2017). Adoption of renewable heating systems: An empirical test of the diffusion of innovation theory. *Energy*, *125*, 313–326. https://doi.org/10.1016/j.energy.2017.02.060

Furman, J. L., Porter, M. E., & Stern, S. (2002). The determinants of national innovative capacity. *Research Policy*, *31*(6), 899–933. https://doi.org/10.1016/S0048-7333(01)00152-4

Gerlach, S., & Brem, A. (2015). What determines a successful business incubator? Introduction to an incubator guide. *International Journal of Entrepreneurial Venturing*, 7(3), 286–307. https://doi.org/10.1504/IJEV.2015.071486

Hu, M. C., & Mathews, J. A. (2005). National innovative capacity in East Asia. *Research Policy*, *34*(9), 1322–1349. https://doi.org/10.1016/j.respol.2005.04.009

t. XXX, nr 12/2023 DOI 10.33226/1231-7853.2023.12.3

Huergo, E. (2006). The role of technological management as a source of innovation: Evidence from Spanish manufacturing firms. *Research Policy*, *35*(9), 1377–1388.

Jiménez, A., & Zheng, Y. (2018). Tech hubs, innovation and development. *Information Technology for Development*, *24*(1), 95–118. https://doi.org/10.1080/02681102.2017.1335282

Kirner, E., Kinkel, S., & Jaeger, A. (2009). Innovation paths and the innovation performance of low-technology firms – An empirical analysis of German industry. *Research Policy*, *38*(3), 447–458. https://doi.org/10.1016/j.respol.2008.10.011

Kline, S. J., & Rosenberg, N. (2009). An overview of innovation. In: N. Rosenberg (Ed.), *Studies on science and the innovation process: Selected works by Nathan Rosenberg* (173–203). World Scientific Publishing.

Paci, R., & Usai, S. (1999). Externalities, knowledge spillovers and the spatial distribution of innovation. *GeoJournal*, *49*, 381–390.

Ritala, P., Olander, H., Michailova, S., & Husted, K. (2015). Knowledge sharing, knowledge leaking and relative innovation performance: An empirical study. *Technovation*, *35*, 22–31. https://doi.org/10.1016/j.technovation.2014.07.011

Rosenberg, N. (Ed.). (2009). *Studies on science and the innovation process: Selected works by Nathan Rosenberg*. World Scientific Publishing.

Sohn, D. W., & Kenney, M. (2007). Universities, clusters, and innovation systems: The case of Seoul, Korea. *World Development*, *35*(6), 991–1004. https://doi.org/10.1016/j.worlddev.2006.05.008

Su, T. (2019, February). Building Science and Technology Innovation Centre in Beijing should care about industry application. *IOP Conference Series: Earth and Environmental Science*, *237*(5), 052063.

Szeto, E. (2000). Innovation capacity: Working towards a mechanism for improving innovation within an inter-organizational network. *The TQM Magazine*, *12*(2), 149–158.

Troshin, A. S., Kupriyanov, S. V., Stryabkova, E. A., Saldanha, H. F. D., & Sandu, I. S. (2014). Role and place of economic mechanism in modern conditions. *Life Science Journal*, *11*(10), 487–490.

Uzlov, K., & Li-chun, T. (2016). Indicator evaluation of regional innovation system according to the cluster approach. *Scholedge International Journal of Business Policy & Governance*, *3*(12), 178–184. https://doi.org/10.19085/journal.sijbpg031201

Wu, J., Ge, Z., Han, S., Xing, L., Zhu, M., Zhang, J., & Liu, J. (2020). Impacts of agricultural industrial agglomeration on China's agricultural energy efficiency: A spatial econometrics analysis. *Journal of Cleaner Production*, *260*, 121011. https://doi.org/10.1016/j.jclepro.2020.121011

Yam, R. C., Lo, W., Tang, E. P., & Lau, A. K. (2011). Analysis of sources of innovation, technological innovation capabilities, and performance: An empirical study of Hong Kong manufacturing industries. *Research Policy*, *40*(3), 391–402. https://doi.org/10.1016/j.respol.2010.10.013

Yuasa, M. (1962). Centre of scientific activity: Its shift from the 16th to the 20th century. *Japanese Studies in the History of Science*, *1*(1), 57–75.

Zhang, J. (2019, December). A study on innovation radiation effects of Shanghai Science and Technology Innovation Centre from the perspective of field theory. *IOP Conference Series: Materials Science and Engineering*, *677*(4), 042044.

Zhao, S. L., Song, W., Zhu, D. Y., Peng, X. B., & Cai, W. (2013). Evaluating China's regional collaboration innovation capability from the innovation actors perspective – An AHP and cluster analytical approach. *Technology in Society*, *35*(3), 182–190. https://doi.org/10.1016/j.techsoc.2013.06.001

Prof. Li Dan

PhD, associate professor in Department of Public Administration, Northeastern University, China. Her research interests include public policy, especially science and technology policies, administration of cultural affairs in China and the governance of China.

Bai Yihan

Graduate student in Department of Public Administration, Northeastern University, China.

Prof. Li Dan

Doktor, profesor nadzwyczajny na Wydziale Administracji Publicznej na Northeastern University w Chinach. Jej zainteresowania badawcze obejmują politykę publiczną, zwłaszcza politykę naukową i technologiczną, administrowanie sprawami kulturalnymi w Chinach oraz zarządzanie Chinami.

Bai Yihan

Absolwent studiów na Wydziale Administracji Publicznej na Northeastern University w Chinach.