Analysis of the Current Situation of Science and Technology Innovation Platforms in China's Housing and Urban-Rural Construction Sector and Development Suggestions

Yue Chen[1,2], Mengyue Peng[3,*], Wanpeng Wang[1,2]

[1]Beijing Advanced Innovation Center for Future Urban Design, Beijing, China
[2]Beijing University of Civil Engineering and Architecture, Beijing, China
[3]Science and Technology and Industrialization Development Center, Ministry of Housing and Urban-Rural Development, Beijing, China

Abstract: Science and technology innovation platform is an important carrier to carry out basic research, common key technology research and development of industry, transformation and industrialisation of scientific and technological achievements, and scientific and technological resources sharing service and other scientific and technological innovation activities according to the development of scientific frontiers, national strategic needs and industrial innovation and development needs, and it is an important part of the national and regional innovation system. This study employs a systematic literature review and analysis of publicly available official data from sources including the Chinese Ministry of Science and Technology, National Development and Reform Commission, Ministry of Education, and other relevant ministries, as well as university websites and official news releases. Data collection focused on the inventory, distribution, and management policies of various national and ministerial-level science and technology innovation platforms up to June 2023. In this paper, we systematically sort out the status quo of science and technology innovation platforms, analyse the existing problems of science and technology innovation platforms in the field of housing and construction, and put forward the development suggestions to further strengthen the construction and management of science and technology innovation platforms in the field of housing and construction, so as to serve the high-quality development of housing and urban-rural construction undertakings through science and technology innovation platforms as a hand.

1. Introduction

The CPC Central Committee pays great attention to the construction and development of science and technology innovation platforms, and General Secretary Xi Jinping has pointed out that "strengthening the national strategic science and technology force and enhancing the overall effectiveness of the national innovation system"[1]." Strengthen the construction of research platforms and give full play to their role."[2]The Ministry of Housing and Urban-Rural Development actively implements the strategy of strengthening the country with science and technology, and Ni Hong, secretary of the party group and minister of the ministry, pointed out that "we insist on reform and innovation, and strengthen scientific and technological leadership. Adhere to science and technology is the first productive force, and continue to consolidate and enhance the world's leading technology in the field of housing and urban and rural construction."[3] "Take system innovation and scientific and technological innovation as the engine to stimulate the power and vitality of high-quality development of housing and urban-rural construction."[4] The science and technology innovation platform is an innovation point for carrying out cutting-edge science and technology research, a basic point for attracting and nurturing high-level talents, a reinforcement point for optimising the allocation of scientific resources, and a meeting point for academic exchanges and the transformation of results. The science and technology innovation platform in the field of housing and construction is an important part of the science and technology innovation system in the field of housing and urban-rural construction, and it is an important innovation carrier to support and lead the green development of urban and rural construction, implement the goal and task of carbon peak and carbon neutrality, and promote the new type of urbanisation centred on human beings, and push forward the high-quality development of housing and urban-rural construction.

2. Research Methodology

This research is primarily based on a qualitative analysis of secondary data. The data collection process involved systematically retrieving and compiling information from the following sources:

(1)Official Government Websites: Primary data were extracted from the official websites of key Chinese

*peng_my12@163.com

ministries and commissions, including the Ministry of Science and Technology (MOST), the National Development and Reform Commission (NDRC), the Ministry of Education (MOE), and the Ministry of Housing and Urban-Rural Development (MOHURD). This included policy documents, official announcements, departmental budgets, and platform directories.

(2)Institutional Websites: Data on specific platforms were gathered from the websites of hosting institutions, such as universities and research academies.

(3)Official News Releases and Public Reports: Information was supplemented from state-media news articles and official press releases related to platform establishment, funding, and performance.

The data analysis method involved a systematic categorization and comparative analysis of the collected data to identify patterns in the distribution (by field, type, leading institution), funding mechanisms, and management systems of science and technology innovation platforms. The analysis focused on juxtaposing the platform distribution within the housing and construction sector against its economic significance (GDP contribution) and national strategic priorities to identify gaps and imbalances.

3. Status of development of science and technology innovation platforms in China

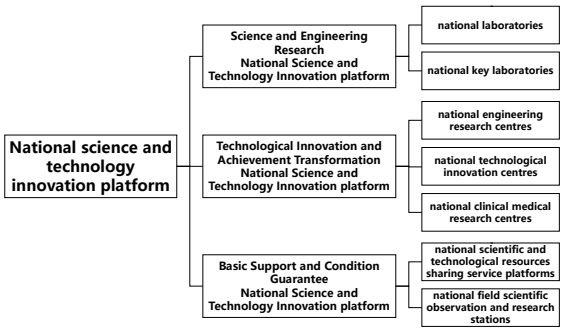

Figure 1 Diagram of the structure and system of China's national science and technology innovation platforms

National science and technology innovation platform is an important hand to realise high-level scientific and technological self-reliance and self-improvement, and is an important part of the national innovation system, which is constructed according to the layout of the three categories of scientific and engineering research, technological innovation and achievement transformation, and basic support and condition guarantee[5]. Among them, Science and Engineering Research National Science and Technology Innovation platform include national laboratories and national key laboratories; Technological Innovation and Achievement Transformation National Science and Technology Innovation platform include national engineering research centres, national technological innovation centres and national clinical medical research centres; and Basic Support and Condition Guarantee National Science and Technology Innovation platform include national scientific and technological resources sharing service platforms and national field scientific observation and research stations, as shown in Figure 1.

3.1. Status of national science and technology innovation platforms in the field of housing and construction

National science and technology innovation platforms related to the housing and urban-rural construction fields mainly include scientific and engineering research platforms (national laboratories, national key laboratories) and technological innovation and results transformation platforms (national engineering research centres, national technological innovation centres).

National Science and Technology Innovation Platforms for Science and Engineering Research:

(1) National Laboratory

National laboratories are strategic scientific and technological forces embodying the national will, realising the national mission and representing the national level; they are innovative basic platforms for international scientific and technological competition; they are the core support for guaranteeing national security; and they are large-scale comprehensive research platforms integrating breakthroughs, leaders and platforms.[5]

The Chinese Ministry of Science and Technology has initiated the pilot construction of national laboratories since 2000, with the original 24 [6,7], Of these, 6 national laboratories were converted into national research centres[7], There are currently 18 national laboratories (including preparations). It is mainly distributed in five areas, including basic research, natural resources, transport, agriculture and rural areas, and energy, as shown in Figure 2. For the time being, there is no expression of financial support for national laboratories from public sources, and in the case of the Qingdao National Laboratory for Ocean Science and Technology, which has officially started construction[8], the budgets for 2021 and 2022 are 345 million yuan[9] and 352 million yuan, respectively[10]. There is only one related to the housing sector, see Table 1, accounting for 5.56 % of the total, which is distributed in the transport sector and is led by the university.

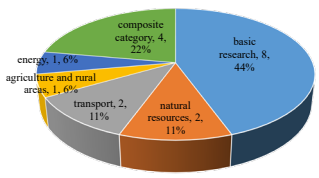

Figure 2 Distribution of national laboratory areas

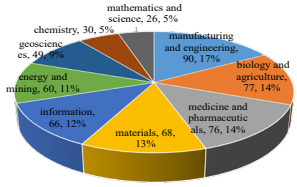

Figure 3 Distribution of State Key Laboratory Areas

Table 1 Catalogue of national laboratories in the field of housing and construction

No.	designation	supporting unit	Construction status/area
1	Southwest Jiaotong University[11]	Southwest Jiaotong University	Preparation/Transport

Note: The National Laboratory [12]for Modern Rail Transportation is one of the 10 national laboratories initiated by the Chinese Ministry of Science and Technology in December 2006[13] in 10 important directions, such as oceans and seas, aerospace, population and health, nuclear energy, new energy, advanced manufacturing, quantum regulation, protein research, agriculture and rail transportation, in preparation for the establishment of national laboratories[6].

(2) State Key Laboratories

State Key Laboratory is a national scientific and technological innovation platform oriented to frontier, basic and engineering sciences, promoting the development of disciplines, enhancing the ability of original innovation, promoting technological progress, and carrying out scientific and technological innovation activities, such as strategic, frontier and prospective basic research, applied basic research and other scientific and technological innovation activities.[5]

The construction of national key laboratories has been initiated since 1984[14], but compared with the requirements of comprehensively strengthening basic scientific research and building a world power in science and technology, there are still problems such as the lack of major original achievements, the lack of world-class leading scientists, and the urgent need to deepen the management system and mechanism[13]. In 2018, the Chinese Ministry of Science and Technology (MOST) carried out optimisation, adjustment and new construction of national key laboratories and reorganised them into national key laboratories, with the number increasing steadily, and the total number is planned to be maintained at about 700, of which the number of disciplinary categories will be maintained at about 300, the number of enterprise categories will be maintained at about 270, and the number of categories jointly built by Provincial-Ministerial Co-construction will be maintained at about 70[13].

The new national key laboratories approved for construction in 2019 highlight the cross-disciplinary attributes of their research fields [14], and by 29 June 2023, at least 150 "state-heavy" laboratories will have completed their reorganisation and been renamed as national key laboratories[15]. According to the annual accounts of the Chinese Ministry of Science and Technology (MOST), the basic research (section) is mainly used for the special funds for the national key laboratories, and the budget figures at the beginning of the year 2021~2023 were RMB 7,691 million[16], RMB 5,516 million[17] and RMB 7,862 million[18], respectively.

There are a total of 542 national key laboratories[13], which are divided into five categories, namely, disciplines, enterprises, Provincial-Ministerial Co-construction, Hong Kong and Macao, and national research centres, depending on the mode of construction[14], as shown in Table 2. The national key laboratories are distributed in nine fields, including manufacturing and engineering, biology and agriculture, medicine and pharmaceuticals, materials, information, energy and mining, geosciences, chemistry, mathematics and science, of which 90 (16.6%) are in the field of manufacturing and engineering, 77 (14.2%) are in the field of biology and agriculture, 76 (14.1%) are in the field of medicine and pharmaceuticals, and the rest account for less than 14%. See Figure 3. At present, a total of 350 national key laboratories can be queried (because the official website of the Chinese Ministry of Science and Technology does not have a summary list of systematically categorised national key laboratories, it is special to find the approval documents of each laboratory, and the query channels include: the official website of the Chinese Ministry of Science and Technology, the Internet, WeChat, etc.), there are 15 related to the field of housing and construction, accounting for 2.77%, with a total of 10 (66.67%) mainly in disciplinary fields; mainly in the fields of manufacturing and engineering (11, 73.33%), materials (3, 20.00%) and geosciences (1, 6.67%); a total of 11 (73.33%) led by universities/research institutes, and 4 (26.67%) led by enterprises.

Table 2 Distribution of types of national key laboratories[14]

Type	Number	Percentage
State Key Laboratories of Disciplines	273	50.37%
State Key Laboratory of Enterprise	178	32.84%
State Key Laboratories of Provincial-Ministerial Co-construction	64	11.81%
State Key Laboratory of Hong Kong and Macao	20	3.69%
National Research Centre	6	1.11%
Pilot National Laboratories	1	0.18%
Total	542	100.00%

National Science and Technology Innovation Platform for Technological Innovation and Transformation of Achievements:

(1) National Engineering Research Centre

The National Engineering Research Centre is a national scientific and technological innovation platform which is oriented to the needs of national major strategic tasks and key engineering construction, carries out key technology research and experimental research, development of major equipment, experimental verification of engineering of major scientific and technological achievements, breaks through the constraints of key technologies and core equipment, and supports the construction of national major projects and the development of key industries.[5]

There were originally 349 national engineering research centres, and in 2021 the National Development and Reform Commission carried out the optimisation and integration of national engineering research centres in two batches, with a total of 191 being approved for inclusion in the new sequence[19]. The China Development and Reform Commission organizes the National Engineering

Research Centre to apply for post-subsidy funding support, with the proportion of post-subsidy funding not exceeding 50% of the project budget[20]. National engineering research centres are distributed in eight fields, including basic research, energy, medicine, transportation (including aerospace), industry and information, agriculture and rural areas, natural resources and ecological protection, of which 55 (28.8%) are in the field of basic research, 27 (14.14%) are in the field of transportation (including aerospace) and the rest account for less than 14% of the total, as shown in figure 4. There are seven national engineering research centres related to the field of housing and construction, accounting for 3.67% of the total, mainly in the fields of transport (six, 85.71%) and building materials (one, 14.29%), with a total of five (71.43%) led by enterprises and two (28.57%) led by universities.

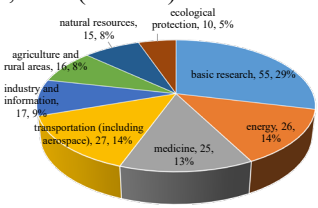

Figure 4 Distribution of National Engineering Research Centre Fields

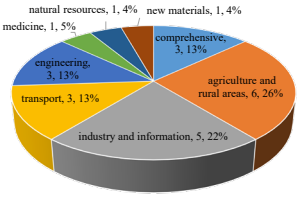

Figure 5 Distribution of areas of national technological innovation centres

(2) National Technology Innovation Centre

National technological innovation centre is a national technological innovation platform for the country to respond to the industrial changes triggered by the scientific and technological revolution, to face the high point of international industrial technological innovation, to face the development needs of key industries and sectors, and to carry out research and development of common and key technologies and products, transfer and transformation of scientific and technological achievements, and demonstration of their application, focusing on the technological fields of major industries and sectors that will affect the long-term development of the country.[5]

In 2017, China's Ministry of Science and Technology (MOST) initiated the layout and construction of National Technological Innovation Centres[21], formerly known as National Engineering and Technology Research Centres (NERCs), with a total of 360[22], and gave priority to supporting eligible NERCs to convert into National Technological Innovation Centres[23].There are a total of 23 national technological innovation centres, which are divided into comprehensive categories and field categories for layout and construction according to different functional positioning, comprehensive and technological[23].

There are three comprehensive national technology innovation centres[24] (Beijing-Tianjin-Hebei, Guangdong-Hong Kong-Macao Greater Bay Area and Yangtze River Delta National Technology Innovation Centre) and two in the pipeline (Chengdu-Chongqing[25,26] and Changsha[27] / Zhengzhou[28] National Technology Innovation Centres), which are led by the relevant local governments or jointly constructed by multi-local linkages, to carry out cross-region, cross-domain, cross-discipline synergistic innovation and open cooperation around the implementation of the country's major regional development strategies and promotion of the innovative development of key regions. There are 20 national technological innovation centres (data searched through the official website of the Ministry of Science and Technology, the Internet, WeChat and other channels, from many sources, and there is no public data on the summary list of national technological innovation centres for the time being), which are mainly constructed by the local governments or relevant departments in conjunction with universities, institutes and backbone enterprises that have outstanding advantages in scientific research, gathering and integrating relevant scientific research strength and innovation resources, and driving upstream and downstream advantageous enterprises, universities, institutes and so on to participate in the construction of the centres. Participate in the construction.

China's Ministry of Finance arranges post-subsidy funding in conjunction with the results of performance evaluation[23], and local governments also provide different amounts of funding support, for example, Chongqing Municipality will give a one-time grant of up to 10 million RMB to newly recognised National Technological Innovation Centres (NITICs), and will give up to 6 million RMB each time for project funding in accordance with the results of the Chinese Ministry of Science and Technology (MOST)'s assessment and evaluation[29].

National technological innovation centres are distributed in seven fields, including agriculture and rural areas, industry and information, transport, engineering, medicine, natural resources and new materials, of which six (26.09 per cent) are in the agriculture and rural areas, five (21.74 per cent) are in the industry and information areas, and the rest account for less than 14 per cent of the total, as shown in figure 5. There are three national technology innovation centres related to the field of housing and construction, accounting for 13.04 per cent of the total, all of which are distributed in the field of engineering, with two (66.67 per cent) led by universities/research institutes and one (33.33 per cent) led by an enterprise.

3.2. Status of science, technology and innovation platforms in relevant ministries.

The relevant ministries and commissions in China have made an early start in the planning of science and

technology innovation platforms, laid out a wide range of fields, constructed a large number of them and developed them at a fast pace, and established a closely connected and reasonably graded layout pattern with the national science and technology innovation platforms, which basically formed a system of "prospective research - basic research - applied basic research - cross-disciplinary/collaborative innovation research - scientific and technological achievements transformation and industrialisation". "The system of scientific and technological innovation platforms has basically been formed. For the number and types of science and technology innovation platforms of relevant Chinese ministries and commissions, see Figure 6.

The Ministry of Education of China has a wide range of science and technology innovation platforms and a large scale, with a total size of about 1,691, including 451 key laboratories, 455 engineering research centres, 516 innovation and intellectual platforms for disciplines in institutions of higher education, 183 collaborative innovation centres, 57 joint laboratories for international cooperation, 18 cutting-edge science centres, and 11 large platforms for integrated research and development. The Ministry of Transport of China has a total of 178 science and innovation platforms, including 60 key laboratories, 86 R&D centres, 19 industry collaborative innovation platforms, and 13 field scientific observation platforms. The Ministry of Natural Resources of China has a total of about 272 science and innovation platforms, including 119 key laboratories, 86 engineering technology innovation centres and 67 field scientific observation research stations.

Through the establishment of operation management system, ministries and commissions have further standardised the management of various types of science and innovation platforms. The Ministry of Transport of China has established corresponding management methods for four types of science and innovation platforms, including key laboratories, R&D centres, industry collaborative innovation platforms and field scientific observation platforms; the Ministry of Education of China has introduced corresponding assessment and evaluation rules to further refine the management mode. In order to further refine the management mode, the Ministry of Education of China has issued corresponding assessment rules, and for the key laboratories, it has issued the "Assessment Rules for Key Laboratories of the Ministry of Education" (No. 3 of Educational Technology〔2007〕), the assessment index system and its description. The Ministry of Education of China requires that the relying units of key laboratories should guarantee the basic operating funds of not less than RMB 1 million yuan per year, an area of not less than 3,000 square metres, and the total value of instruments and equipments of not less than RMB 20 million yuan, and requires that the scale of investment in the fixed assets of engineering centres should not be less than RMB10 million yuan, and that the rooms for research and development and transformation of achievements should not be less than 5,000 square metres, and should be relatively concentrated.

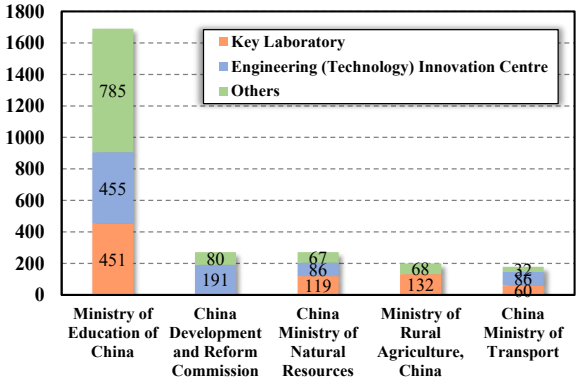

Figure 6 Number and type of science and technology innovation platforms in relevant Chinese ministries and commissions

By building science and innovation platforms, the ministries and commissions have continued to implement large projects, gather large teams and produce large results. South China University of Technology, relying on the Key Laboratory of the Ministry of Education for Subtropical Building Science, has trained 6 engineering academicians and 11 national survey and design masters, and has undertaken the design of major landmarks such as the Guangzhou Tower and the China Pavilion at the Shanghai World Expo; Wuhan University, relying on the Key Laboratory of the Ministry of Natural Resources of the geophysical geodesy, has won more than 30 national and provincial scientific and technological awards, and has more than 50 projects in the research of the National 973 Programme, 863 Programme, etc. every year. More than 50 projects are under research every year, such as the National 973 Programme and 863 Programme.

4. Problems of China's science and technology innovation platform in the field of housing and construction

4.1. Mismatch in the number of national research platforms and imperfect echelon planning and construction.

First, the number of national research platform does not match, housing and urban-rural construction field of construction and real estate industry is the two pillars of the GDP, the value added in 2022 accounted for 6.9% and 6.1% of the GDP, accounting for a total of 13%, is the national economy "pillar" "ballast stone ", it is important to stabilise the economy and achieve high-quality development, and the high-quality development of housing and urban-rural construction must be empowered by science and technology.[3] However, at present, the proportion of national scientific research platforms in China's housing and construction sector is relatively low, with national laboratories accounting for 5.56%, national engineering research centres for 3.67%, national key laboratories for 2.77%, and national technological innovation centres for 13.04%, so that the number of national scientific research platforms in the field of

China's housing and construction sector does not match the proportion of GDP.

Secondly, the planning and construction of echelons is not perfect, and the relevant Chinese ministries and commissions have all set up national, ministerial and industry key laboratories and engineering technology research centres, with a more comprehensive platform system. China's Ministry of Housing and Urban-Rural Development has also been paying attention to the construction of scientific research and innovation platforms, and in 2021 launched the identification of national key laboratories for urban and rural construction and engineering technology innovation centres, but the systematicness, concentration and display of the planning and construction are still insufficient, with insufficient major original achievements and the influence of the industry to be improved.

4.2. Uneven layout of industry sectors and in-depth cross-fertilisation of disciplines.

Firstly, the layout of industry fields is not balanced. The housing and urban-rural construction field involves a number of professional fields, such as building energy efficiency and green low-carbon development, new building industrialization, urban renewal and new urban infrastructure construction, rural construction, housing and real estate market, etc. However, at present, China's national science and innovation platforms in the field of housing and construction are more in the layout of the transport field, accounting for about 25.58%, among which, the national engineering research centre accounts for as high as 85.71% in the transport field. The proportion of national engineering research centres in the field of transportation is as high as 85.71%, and the layout of the industry is not balanced, so the relevant key areas are in urgent need of the construction of science and innovation platforms to stimulate the vitality of innovation and enhance the kinetic energy of innovation.

Secondly, the cross-disciplinary integration is not in-depth. Driven by China's major national strategic needs, multi-disciplinary cross convergence and multi-technology cross-border integration will become the norm, and the cross-cutting attributes of the research fields of the various newly-approved science and innovation platforms are also becoming more and more prominent, for example, the State Key Laboratory of Cognition of Communication Contents (relying on People's Daily Newspaper People's Daily), which was approved by the Ministry of Science and Technology of China for construction in 2019, carries out applied basic research on AI with AI as the core. applied basic research on communication content cognition, and the State Key Laboratory of Ultra-High-Definition Audio and Video Production and Broadcast Presentation (built with the support of China Central Radio and Television (CCTV)), which explores the cross-fertilisation of AI (Artificial Intelligence) technology with 4K/8K Ultra-High-Definition (4K/8K) video technology and 5G media applications. The Ministry of Housing and Urban-Rural Development (MOHURD) has also carried out the construction of "New City Construction" driven by innovation in the application of new-generation information technology, and synergistically developed intelligent construction and industrialisation of construction to promote the transformation and upgrading of the construction industry.

The uneven distribution of innovation platforms and the lack of cross-fertilization in China's housing and construction sector stem from a combination of historical policy biases, systemic structural barriers, and institutional constraints. Historically, national science and technology planning has exhibited a clear prioritization of sectors deemed strategically critical for global competitiveness and national security, such as aerospace, information technology, and basic sciences. These fields have consistently received disproportionate funding and policy support, creating a significant resource gap for traditionally perceived industries like housing and construction. While recent emphasis on green development and intelligent construction has begun to elevate the sector's profile, it has not yet fully compensated for decades of relatively lower strategic prioritization. Compounding this historical legacy are deep-seated systemic barriers. The inherent challenges in coordinating across different administrative departments (e.g., transport, energy, and construction) result in fragmented planning and resource allocation. This departmental siloing is further reinforced by the persistent disciplinary silos within academic and research institutions, which hinder the development of integrated platforms capable of addressing the complex, systemic challenges of modern urban and rural development. Ultimately, this combination of historical policy inclination, interdisciplinary coordination challenges, and entrenched institutional structures has collectively constrained the development of a more balanced and synergistic ecosystem for science and technology innovation platforms in this vital sector.

However, the emergence of new research directions and technological growth points is insufficient, and there is a lack of layout of scientific research and innovation platforms for the cross-cutting fields of related disciplines. However, new research directions and technological growth points have not emerged sufficiently, and there is a lack of scientific research and innovation platforms for related interdisciplinary fields, and the degree of interdisciplinary integration needs to be further improved.

4.3. Inadequate operational and management mechanisms and inadequate pooling of resources

First, the operation and management mechanism is not sound; the Chinese Ministry of Science and Technology, the Chinese Ministry of Education and other relevant ministries and commissions have established relatively sound operation and management mechanisms, clarifying the functional positioning, access requirements, performance objectives and assessment programmes of various types of science and technology innovation platforms, which have facilitated the orderly conduct of

organized scientific research by various science and technology innovation platforms. The Ministry of Housing and Urban-Rural Development (MOHURD) also attaches great importance to the establishment of the management system of science and technology innovation platforms, and issued 《the Interim Measures for the Management of National Science and Technology Innovation Platforms for Urban and Rural Construction》 (Jianbiao [2022] No. 9) in January 2022. But the relative lack of granularity in MOHURD's management mechanisms compared to other ministries like the MOE may stem from the later systematic initiation of its platform construction efforts in 2021. This late start has resulted in less accumulated experience in standardized platform governance, performance evaluation, and long-term strategic planning specific to the diverse and applied nature of the construction sector's research needs. The depth and breadth of management still needs to be strengthened.

Secondly, the convergence of resources is insufficient. This insufficient is compounded by the industry's inherent interdisciplinary complexity—spanning architecture, civil engineering, materials science, and information technology—where siloed disciplines operate with distinct standards and terminology, hindering collaborative innovation. Additionally, diverse regional conditions—such as climate variations, geographical features, and localized regulations—impede the adoption of unified national standards, fostering practices that resist interoperability. These challenges are further exacerbated by a lack of robust data governance frameworks and trusted sharing mechanisms, discouraging stakeholders from contributing to collective resource pools. Together, structural fragmentation, disciplinary silos, regional diversification, and weak data governance systematically constrain effective resource integration, limiting the sector's capacity for synergistic advancement.

5. Suggestions on the Layout and Construction of Science and Technology Innovation Platforms in China's Housing and Construction Sector

In order to strengthen the construction of science and technology innovation platforms and to empower the high-quality development of China's housing and urban-rural construction undertakings with science and technology, the following recommendations are put forward:

5.1. Strengthening the preparation of strategic scientific and technological forces and continuously improving the system of scientific research platforms.

Firstly, it has strengthened the planning and layout of national key laboratories and national technology innovation centres in the field of housing and construction. We will continue to consolidate and enhance the world's leading technologies in the field of housing and urban-rural construction, focus on breakthroughs in "neck-breaking" technologies, continue to achieve major original results, climb the world's scientific and technological peaks, lead the industry to the middle and high end of the world with major equipment and projects, and support the enhancement of China's national core competitiveness with strategic high-tech research. It actively supports the Ministry's scientific research units, industry backbone enterprises, colleges and universities, and research institutes to actively declare national key laboratories and national technological innovation centres.

Secondly, the overall planning, systematic layout and classification management of various types of science and innovation platforms will improve the system of scientific research platforms. Continuously carry out the construction of national key laboratories for urban and rural construction and engineering technology innovation centres, explore the construction of provincial and ministry joint construction and industry collaborative innovation centres, clarify the division of labor and positioning of each platform, and build a general layout that is organically connected with and mutually supportive of national science and technology innovation platforms; widely absorb leading enterprises, colleges and universities, and scientific research institutes to participate in the construction of scientific and technological innovation platforms for the field of housing and construction, integrate and share resources, and give play to the synergistic power of innovation, so as to establish The system of scientific and technological innovation platforms is orderly, reasonably structured and clearly positioned.

5.2. Aiming at the major needs of the national industry and grasping the cross-fertilisation of cutting-edge technologies.

First, anchored in China's major national strategies and key engineering needs, relying on science and innovation platforms, to carry out key core technology research and development. It has laid out science and innovation platforms in key areas such as urban and rural green and low-carbon development, intelligent construction, quality enhancement, and historical and cultural preservation, promoted the engineering and industrialisation of major scientific and technological achievements, vigorously promoted the application of new materials, new work methods, new products and other practical technologies benefiting the people, provided high-quality construction products for the whole society, and enhanced the ability of scientific and technological innovation to serve economic and social development.

Secondly, it is to lay out and build scientific and technological innovation platforms in cross-disciplinary fields, give full play to the characteristics of multi-disciplinary intersection, multi-professional fusion and multi-subject cooperation in the field of housing and construction as an aggregate, build collaborative innovation research groups, carry out cross-disciplinary

and cross-field exploration of scientific and technological fronts and collaborative innovations, open up new disciplinary directions and research fields, continuously give rise to new disciplinary fronts, new scientific and technological fields, and new forms of innovations, so that it can play a leading and driving role in the national innovation system of China.

5.3. Establishing a sound operation and management mechanism and expanding the channels for gathering scientific and technological factors.

First, China's Ministry of Housing and Urban-Rural Development has issued a series of management measures to improve the construction, management and assessment and evaluation index system of scientific research and innovation platforms, to establish a governance structure, access indexes and an operation and management system compatible with the objectives and positioning of various types of scientific research and innovation platforms, to further clarify the responsibilities of all parties, and to improve the evaluation of results, assessment rules, assessment programmes and exit systems, so as to promote the construction of the platforms and accelerate their development through evaluation.

The second is to widely absorb social forces to participate in the construction and management of housing construction science and innovation platforms, enhance the ability to guarantee scientific research conditions, incorporate enterprises, universities, research institutions and other units into the open and sharing network, support science and technology leading enterprises to focus on the major needs of the country and the industry to take the lead in the construction of science and innovation platforms, use platforms as the handles to continuously undertake major scientific research projects, cultivate high-level talents and teams, solidify the support of science and innovation carriers, serve the central work of the Ministry of Science and Technology and the development of the industry, enhance the efficiency of the gathering and circulation of innovation elements, and create a good atmosphere of joint construction, common governance, common management and sharing.

6. Conclusion

As a core carrier of technological innovation and key part of the national innovation system, science and technology (S&T) innovation platforms are vital to the high-quality development of China’s housing and urban-rural construction sector—a national economic pillar and livelihood cornerstone.

On one hand, China has initially built a multi-level platform system covering scientific research, tech innovation, and achievement transformation, laying a foundation for frontier research, talent gathering, and resource integration, with breakthroughs in areas like transportation infrastructure. On the other hand, three core issues remain: 1) The number of national platforms mismatches the sector’s GDP contribution, and platform echelon planning is inadequate; 2) Industrial layout is unbalanced and interdisciplinary integration is weak, failing to meet demands in intelligent construction and green low-carbon development; 3) Operational mechanisms are underdeveloped, and resource pooling is hindered by silos, limiting innovation synergy.

To address these, targeted measures are proposed: strengthen strategic layout; optimize industrial orientation; and refine operational mechanisms. Looking ahead, these platforms must align with national strategies. By implementing the above suggestions, they will better act as “innovation engines”—driving original tech breakthroughs, accelerating achievement transformation, and nurturing talents—providing strong S&T support for the sector’s upgrading, enabling high-level tech self-reliance, and contributing to national economic sustainability and people’s well-being.

Acknowledgments

Grant sponsor: Ministry of Education Industry-University Cooperation and Collaborative Education Project and Grant no: 231100899210024;Beijing University of Civil Engineering and Architecture Graduate Education and Teaching Quality Improvement Project and Grant no: J2025016.

References

1. Xi Jinping. Accelerating the construction of a science and technology powerhouse to achieve a high level of scientific and technological self-reliance and self-improvement[J]. Seeking truth, 2022(09)
2. People's Daily Online - Database of Xi Jinping's Important Speeches. Xi Jinping: deepen reform of science and technology system to enhance the vitality of scientific and technological innovation and truly put the innovation-driven development strategy into practice.[EB/OL]. (2013-07-18) [2023-10-11]. http://jhsjk.people.cn/article/22233331
3. Ni Hong. Writing a new chapter on high-quality development of housing and urban-rural construction [N]. Study Times, 2023-06-28 (001).
4. China Daily. National Housing and Urban-Rural Construction Work Conference Held in Beijing.[EB/OL]. (2013-01-17) [2023-10-11]. https://baijiahao.baidu.com/s?id=1755262707768174829&wfr=spider&for=pc
5. Ministry of Science and Technology of the People's Republic of China. Ministry of Science and Technology National Development and Reform Commission Ministry of Finance on the issuance of the "Thirteenth Five-Year" National Science and Technology Innovation Platform and Conditional Guarantee Capacity Building Special Plan" Notice. [EB/OL]. (2017-10-26) [2023-10-11]. https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/fgzc/gfxwj/gfxwj2017/201710/t20171026_135754.html

6. Xu Zhiguo. Why it is difficult to produce national laboratories[J]. Science News, 2011(11): 3.
7. Ministry of Education of the People's Republic of China. Six National Laboratories (Preparatory) Approved to Form National Research Centres.[EB/OL]. (2017-11-22) [2023-10-11]. http://www.moe.gov.cn/jyb_xwfb/s5147/201711/t20171128_320095.html
8. Ministry of Science and Technology of the People's Republic of China. Qingdao Marine National Laboratory officially opened. [EB/OL]. (2015-12-05) [2023-10-11]. https://www.most.gov.cn/dfkj/sd/zxdt/201512/t20151214_122893.html
9. Qingdao Municipal People's Government . Departmental Budget of Qingdao National Laboratory for Marine Science and Technology Development Centre in 2021. [EB/OL]. (2021-02-07) [2023-10-11]. http://www.qingdao.gov.cn/ywdt/zwzl/bmyjs/2021/hysys/czys/202102/t20210207_2963470.shtml
10. Qingdao Municipal People's Government. Departmental Budget of Qingdao National Laboratory for Ocean Science and Technology Development Centre, 2022. [EB/OL]. (2022-05-13) [2023-10-11]. http://www.qingdao.gov.cn/ywdt/zwzl/bmyjs/2022/czyjs2022_44/czys_2022/202205/t20220513_6049103.shtml
11. Official website of Southwest Jiaotong University. Scientific Research-Scientific Research Base. [EB/OL]. [2023-10-11]. https://www.swjtu.edu.cn/kxyj1.htm#kyjd
12. Ministry of Science and Technology of the People's Republic of China. The Ministry of Science and Technology (MOST) held a briefing on the launch of national laboratory construction. [EB/OL]. (2006-12-14) [2023-10-11]. https://www.most.gov.cn/ztzl/qgkjgzhy/2007/2007jcyj/200701/t20070124_39920.html
13. Central People's Government of the People's Republic of China. Several Opinions on Strengthening the Construction and Development of State Key Laboratories (Guo Ke Fa Ji [2018] No. 64) [EB/OL]. (2018-06-22) [2023-10-11]. https://www.gov.cn/zhengce/zhengceku/2018-12/31/content_5442073.htm
14. Lu Shilin, Li Man. Dilemma of State Key Laboratory Construction and Reorganisation Ideas[J]. China Soft Science, 2023(06): 66 - 78.
15. Southern Weekend. One word, one change: more than 150 state key laboratories reorganised and renamed in one year. [EB/OL]. (2023-07-11) [2023-10-11]. http://www.infzm.com/contents/252025?source=202&source_1=252023
16. Ministry of Science and Technology of the People's Republic of China. Ministry of Science and Technology 2021 Departmental Budget. [EB/OL]. (2021-03) [2023-10-11]. http://www.jgzx.org/docs/20220818182633449507.pdf
17. Ministry of Science and Technology of the People's Republic of China. Ministry of Science and Technology 2022 Departmental Budget. [EB/OL]. (2022-03) [2023-10-11]. https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/bmyjs/202307/P020230726658877941515.pdf
18. Ministry of Science and Technology of the People's Republic of China. Ministry of Science and Technology 2023 Departmental Budget. [EB/OL]. (2023-03) [2023-10-11]. https://www.safea.gov.cn/xxgk/xinxifenlei/fdzdgknr/bmyjs/202303/P020230420570343194281.pdf
19. Circular of the General Office of the National Development and Reform Commission on the Issuance of the List of National Engineering Research Centres Under the Management of the New Sequence (NDRC Hi-Tech [2021] No. 1022)
20. Central People's Government of the People's Republic of China. Circular on the Issuance of the Measures for the Administration of Sub-subsidies for Science and Technology Programmes (Special Projects, Funds, etc.) of the Central Government. [EB/OL]. (2019-12-11) [2023-10-11]. https://www.gov.cn/zhengce/zhengceku/2020-01/03/content_5466399.htm
21. Ministry of Science and Technology of the People's Republic of China. Circular of the Ministry of Science and Technology on the Issuance of Guidelines for the Construction of National Technological Innovation Centres. [EB/OL]. (2017-11-23) [2023-10-11]. https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/fgzc/gfxwj/gfxwj2017/201711/t20171123_136430.html
22. [22] Ministry of Science and Technology of the People's Republic of China. 2016 Annual Report of National Engineering and Technology Research Centre. [EB/OL]. (2018-05-21) [2023-10-11]. https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/zfwzndbb/201805/P020180521579923434724.pdf
23. Central People's Government of the People's Republic of China. Circular of the Ministry of Science and Technology and the Ministry of Finance on the Issuance of the Measures for the Construction and Operation Management of National Technological Innovation Centres (Interim). [EB/OL]. (2021-02-10) [2023-10-11]. https://www.gov.cn/zhengce/zhengceku/2021-02/23/content_5588416.htm
24. Ministry of Science and Technology of the People's Republic of China. Symposium on the Work of National Technological Innovation Centres Held in Beijing [24] Ministry of Science and Technology of the People's Republic of China. [EB/OL]. (2021-11-24) [2023-10-11]. https://www.most.gov.cn/kjbgz/202111/t20211124_178206.html

25. People's Government of Sichuan Province. Chengdu-Chongqing (Xinglong Lake) Integrated Science Centre inaugurated. [EB/OL]. (2023-05-07) [2023-10-11]. https://www.sc.gov.cn/10462/10464/10797/2023/5/7/ba2d6cf3af724d6b8eab9f45be44a268.shtml
26. Chongqing Municipal People's Government. Accelerating the construction of a scientific and technological innovation centre with national influence. [EB/OL]. (2023-03-01) [2023-10-11]. http://www.cq.gov.cn/ywdt/jrcq/202303/t20230331_11832691.html
27. Hunan Provincial Department of Industry and Information Technology. Changsha launches construction of national science and technology innovation centre. [EB/OL]. (2021-12-13) [2023-10-11]. http://gxt.hunan.gov.cn/gxt/xxgk_71033/gzdt/dfgz/202112/t20211213_21312779.html
28. Zhengzhou Zhongyuan District CPPCC. Zhongyuan District CPPCC advises Zhengzhou to build a national regional science and technology innovation centre. [EB/OL]. (2021-10-27) [2023-10-11]. http://www.zyqzx.gov.cn/sitegroup/root/html/90923f944116d04301411a426d10014a/509ba0eb87d84506a6c0df7157a8e6a6.html
29. Chongqing Municipal People's Government. Measures for the Construction and Operation Management of Chongqing Technological Innovation Centre (for Trial Implementation) on 30 May. [EB/OL]. (2023-05-13) [2023-10-11]. http://www.cq.gov.cn/ywdt/jrcq/202305/t20230513_11962739.html?eqid=82d46ee50002291e000000026461d3ac