Research on Financial Support for Scientific and Technological Innovation—Review and Prospect of Development of Financial Science and Technology in Past Ten Years

Lu ZHAO
Institutes of Science and Development, Chinese Academy of Sciences, Beijing 100190, China, evayizhang@outlook.com

See next page for additional authors

Recommended Citation
DOI: https://doi.org/10.16418/j.issn.1000-3045,20220414001
Available at: https://bulletinofcas.researchcommons.org/journal/vol37/iss5/4
Research on Financial Support for Scientific and Technological Innovation—Review and Prospect of Development of Financial Science and Technology in Past Ten Years

Abstract
Since the 18th National Congress of the Communist Party of China (CPC), the central and local finance, in accordance with the requirements of President of the People's Republic of China Xi Jinping, gave full play to their functions, and introduced a series of policies and measures to support scientific and technological innovation, which has effectively promoted the development of science and technology in China. The article reviews the basic situation of financial support for scientific and technological innovation in the past ten years from nine aspects, and looks forward to the future development and reform of financial science and technology.

Keywords
financial; science and technology innovation; review and outlook

Authors
Lu ZHAO, Yu CHENG, and Qi ZHANG
Research on Financial Support for Scientific and Technological Innovation—Review and Prospect of Development of Financial Science and Technology in the Past Ten Years

ZHAO Lu¹, CHENG Yu², ZHANG Qi²
1. Institutes of Science and Development, Chinese Academy of Sciences, Beijing 100190, China;
2. Chinese Academy of Fiscal Sciences, Beijing 100142, China

Abstract: Since the 18th National Congress of the Communist Party of China (CPC), the central and local finance, in accordance with the requirements of President of the People’s Republic of China Xi Jinping, gave full play to their functions, and introduced a series of policies and measures to support scientific and technological innovation, which has effectively promoted the development of science and technology in China. The article reviews the basic situation of financial support for scientific and technological innovation in the past ten years from nine aspects, and looks forward to the future development and reform of financial science and technology.

DOI: 10.16418/j.issn.1000-3045.20220414001-en

Keywords: financial; scientific and technological innovation; review and outlook

Since the 18th National Congress of the Communist Party of China (CPC), the CPC Central Committee with Comrade Xi Jinping as the core put scientific and technological innovation in an extremely important strategic position, and made a series of major strategic deployments. Scientific and technological innovation in China has made remarkable brilliant achievements, with a comprehensive ranking of the 12th place among 132 economic entities in terms of scientific and technological innovation capability, an elevation of 22 places over ten years. Therefore, China became an innovation-oriented country. As the foundation and important pillar for state governance, finance plays a basic, institutional and guaranteeing role in optimizing resource allocation, maintaining market unification, promoting social fairness, and realizing long-term political stability. In specific practices, the finances at all levels gave full play to their functions to enhance investment, innovate the support method, deepen reform in a determined way, and improve institutional system, thus providing strong material support and policy guarantee for scientific and technological innovation. This aroused the vitality of scientific and technological innovation, and made due contributions to science and technology development and reform in China.

1 Enhance investment greatly and provide powerful support for scientific and technological innovation

Investment in science and technology is an important indicator measuring the scientific and technological innovation level and capability of a country. Over the past ten years, investment scale in science and technology in China increased greatly, and the investment structure was optimized constantly. Thus a diversified investment pattern was preliminarily formed.

1.1 A large increase in investment in science and technology

Financial investment in science and technology is the national strategic investment, and the finances at all levels provided key support and guarantee. As shown by the China Statistical Yearbook on Science and Technology, national financial investment in science and technology increased from CNY 560.01 billion in 2012 to CNY 1,009.5 billion in 2020, with an average annual growth of 8.79%. Specifically, the central government’s financial investment in science and technology increased from CNY 560.01 billion in 2012 to CNY 1,009.5 billion in 2020, with an average annual growth of 5.59%; the local financial investment increased from CNY 298.65 billion in 2012 to CNY 633.68 billion in 2020, with an average annual growth of 11.45%.

In addition, by giving play to the leverage effect of financial capital and leading function of financial science and technology policy in a “well-leveraged” way, we have effectively driven the investment of innovation players such as enterprises and relevant social players in science and technology. During 2012-2021, China’s research and experimental development (R&D) expenditure increased from
CNY 1.02 trillion to 2.79 trillion, with an average annual growth of 12.4%. Proportion of R&D expenditure in gross domestic product (GDP) rose from 1.91% to 2.44% \(^{[2,3]}\) (Table 1). At present, China’s R&D expenditure is only secondary to that of the US, ranking the second worldwide.

1.2 Constantly optimized investment structure of science and technology

China’s investment in science and technology laid emphasis on increasing scale and optimizing structure, and by optimization of structure, gathered science and technology resources, highlighted the key support points and released capital efficiency.

Financial investment in science and technology made overall planning and arrangement, optimized the structure and provided key support following the principle of taking public science and technology activities as the scope, “targeting the global sci-tech frontiers, serving the main economic battlefields, striving to fulfill the significant needs of the country and benefiting people’s lives and health” as the orientation, and focusing on national strategic demands as the key point. Taking the central government’s investment in science and technology for example: (1) Support the construction of national strategic science and technology force. We should support the building and running of national laboratory, implementation of first action plan by Chinese Academy of Sciences, implementation of innovation project by Chinese Academy of Agricultural Sciences, Chinese Academy of Medical Sciences and Chinese Academy of Social Sciences, reorganization of national key laboratory, and construction of dual first-class universities. (2) Support basic research and implementing national strategic science and technology tasks. We should guarantee implementation of the National Natural Science Foundation of China, national major special science and technology projects, scientific and technological innovation 2030—major projects and national key R&D program, and provide support for carrying out basic research and R&D of key core technology, and making breakthrough in science and technology for COVID-19 prevention and control. (3) Support construction of high-level science and technology talent teams and innovation base platform. We should support cultivation and introduction of a large batch of high-level leading science and technology talents, innovation team and young science and technology talent reserves, and support construction of national major science and technology infrastructure and national science and technology resource sharing service platform. (4) Support construction of international scientific and technological innovation center and comprehensive national science center, greatly increase capital scale of the central government for guiding local development of science and technology, and support construction of regional innovation highlands in local places.

Regarding insufficient stable financial investment fund in science and technology and the problem of large proportion of competitive fund, finances at all levels have set up a mechanism coordinating stable fund and competitive fund by optimizing the structure and enhancing investment in stable fund. Moreover, the central finance took multiple measures to continue to enhance stable support for scientific research institutions, national major science and technology infrastructure, national key laboratory, basic scientific research business fee, construction of scientific research conditions, etc. Over many years of efforts, the ratio of stable fund to competitive fund in the central financial investment in science and technology was improved from 2:8 to 4.8:5.2.

<table>
<thead>
<tr>
<th>Year</th>
<th>R&amp;D expenditure (CNY 100 million)</th>
<th>R&amp;D expenditure—basic research (CNY 100 million)</th>
<th>R&amp;D expenditure—applied research (CNY 100 million)</th>
<th>R&amp;D expenditure—experimental development (CNY 100 million)</th>
<th>Proportion of basic research in R&amp;D (%)</th>
<th>Growth rate of R&amp;D expenditure (%)</th>
<th>Proportion of R&amp;D expenditure in GDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>1029.841</td>
<td>498.81</td>
<td>1161.97</td>
<td>8637.63</td>
<td>4.84</td>
<td>18.65</td>
<td>1.91</td>
</tr>
<tr>
<td>2013</td>
<td>11846.60</td>
<td>554.95</td>
<td>1269.12</td>
<td>10022.50</td>
<td>4.68</td>
<td>15.03</td>
<td>1.99</td>
</tr>
<tr>
<td>2014</td>
<td>13015.63</td>
<td>613.54</td>
<td>1398.53</td>
<td>11003.56</td>
<td>4.71</td>
<td>9.87</td>
<td>2.02</td>
</tr>
<tr>
<td>2015</td>
<td>14169.88</td>
<td>716.12</td>
<td>1508.64</td>
<td>11905.13</td>
<td>5.05</td>
<td>8.87</td>
<td>2.06</td>
</tr>
<tr>
<td>2016</td>
<td>15676.75</td>
<td>822.89</td>
<td>1610.49</td>
<td>13243.36</td>
<td>5.25</td>
<td>10.63</td>
<td>2.10</td>
</tr>
<tr>
<td>2017</td>
<td>17606.13</td>
<td>975.49</td>
<td>1849.21</td>
<td>14781.43</td>
<td>5.54</td>
<td>12.31</td>
<td>2.12</td>
</tr>
<tr>
<td>2018</td>
<td>19677.93</td>
<td>1090.37</td>
<td>2190.87</td>
<td>16396.69</td>
<td>5.54</td>
<td>11.77</td>
<td>2.14</td>
</tr>
<tr>
<td>2019</td>
<td>22143.60</td>
<td>1335.60</td>
<td>2498.50</td>
<td>18309.50</td>
<td>6.03</td>
<td>12.53</td>
<td>2.24</td>
</tr>
<tr>
<td>2020</td>
<td>24393.11</td>
<td>1467.00</td>
<td>2757.24</td>
<td>20168.88</td>
<td>6.01</td>
<td>10.16</td>
<td>2.40</td>
</tr>
<tr>
<td>2021</td>
<td>27864.00</td>
<td>1696.00</td>
<td>—</td>
<td>—</td>
<td>6.09</td>
<td>14.23</td>
<td>2.44</td>
</tr>
</tbody>
</table>

Data source: China Statistical Yearbook 2012–2021

A benign interaction with optimization of financial investment structure was that there was also a significant change in China’s whole-society R&D expenditure investment structure; especially in recent ten years, the proportion of basic research expenditure in the whole-society R&D expenditure was improved stably. China’s basic research expenditure increased from CNY 49.881 billion in 2012 to CNY 169.6 billion in 2021, with an increase of 2.4 times, at an average annual growth of 12.7%, and its proportion in GDP was also elevated from 4.84% in 2012 to 6.09% in 2021, showing a good growth trend.

1.3 Preliminarily formed diversified investment pattern

The laws and characteristics of science and technology activities have decided that investment in science and technology must expand its source channel, and a diversified investment pattern should be constructed. With improvement of socialist market economy in China, implementation of innovation-driven development strategy and transformation of government functions, investment in science and technology from the whole society has been driven by guidance of financial investment in science and technology, fiscal and tax incentives, etc., and a diversified investment pattern has been formed preliminarily.

In terms of specific policies and measures, by implementation of preferential tax policies, especially additional deduction policy for enterprise R&D expenditure, enterprise R&D investment has been inspired effectively. By implementing major science and technology projects, construction industry-college-institute cooperation and diversified fund-raising mechanism, enterprises were driven to take the lead or participate in R&D of major science and technology projects. By the establishment of relevant government investment fund and public-private partnership (PPP), private capital was drawn to invest in scientific and technological innovation. In the whole-society R&D expenditure in 2020, enterprise investment fund accounted for up to 77.46%.

2 Innovate financial support method and improve financial support efficiency

Financial support method for scientific and technological innovation differs depending on its support subject, phase and content. Innovating financial support methods is conducive to improvement of the support efficiency. Over the past ten years, financial support mode was actively innovated, achieving a desirable effect.

2.1 Optimize science and technology investment method

(1) For R&D project fund for scientific research institutions and colleges and universities, “competition + stability” support mode was adopted. In addition to national science and technology program and other competitive funds, the central finance established basic scientific research business fee for central colleges and universities and scientific research institutions, allowing them to arrange their projects and funds independently. Furthermore, strategic leading science and technology special fund of Chinese Academy of Sciences was established, allowing the academy to deploy and arrange the projects and funds independently in combination with its own mission and function on the basis of making proper cohesion with national science and technology program.

(2) For competitive fund for national science and technology program, the “pre-funding + post-funding” support method was adopted. In addition to the traditional “pre-funding” method, we provided fund support for the units undertaking the projects by means of “post-funding”; that is, the units obtained funds following pre- or post-project approval, investing into R&D first, obtaining achievements and passing the acceptance.

(3) The support method of linking budget arrangement with evaluation results was implemented. We should conduct periodic evaluation on national key laboratories, and arrange the budget in a classified and graded way according to the evaluation results. Further, we should encourage central colleges and universities and scientific research institution to open the sharing of major scientific research infrastructure and large scientific research instrument, and provide reward fund upon their passing evaluation.

(4) The support method of establishing government investment fund was employed for technological innovation of enterprises. For example, national integrated circuit industry investment fund, national emerging industry venture capital investment guidance fund, and national science and technology achievement transformation guidance fund were established, and the management method of government guidance, diversified investments and market operation was adopted, to offer market assistance to innovation players.

(5) Development of scientific and technological innovation was promoted via government procurement. Government procurement was executed for scientific and technological innovation products and services conforming to stipulations. Specifically, first procurement was implemented toward the products and services that were put into market for the first time; subscription was implemented for the products and services to be researched and developed. The governments also supported and encouraged small-and-micro businesses and venture teams to purchase science and technology services in their innovation activities from colleges and universities and scientific research institutions by means of issuing innovation vouchers to them.
2.2 Implement preferential tax policies

Implementing preferential tax policies is a financial policy generally adopted worldwide for supporting scientific and technological innovation. Over the past ten years, China continued to enhance tax preference for scientific and technological innovation, and has formed a preferential tax policy system covering whole innovation chain of venture capital investment, innovation players, R&D activities and achievement transformation. In addition, we adopted the method of combining direct preferences such as low tax rate, tax reduction or exemption with indirect preferences such as additional deduction, accelerated depreciation, pre-tax deduction and tax deferral, which enhanced the dominant role of enterprises in technological innovation, and promoted their development in technological innovation. The tax supports included: (1) For high-tech enterprises, enterprise income tax was collected at the rate of 15%. By relaxing the identification conditions of small and medium high-tech enterprises, proportion of R&D expenditures, proportion of science and technology personnel and intellectual property right conditions appropriately, and expanding high-tech field scope with key support, we enable more small and medium enterprises and emerging enterprises to enjoy preferential policy. (2) Additional deduction was adopted for enterprise R&D expenditures. The proportion of additional deduction for enterprises was improved from 50% to 75%, and that for manufacturing enterprises and science and technology-based small and medium enterprises was improved from 75% to 100%. (3) Tax preference was adopted for science and technology achievement transformation. Value-added tax (VAT) was exempted for technology transfer, technology development and related technology consultation and services. For the rewards for transformation of job-related science and technology achievements obtained by science and technology personnel, individual income tax was allowed deferred payment, and for the cash reward obtained, individual income tax was collected in a half way. For enterprises and individuals making investment and having shareholding with technology achievements, they could select to pay tax in installments in five years or defer to the step of equity transfer. For the enterprise income from technology transfer conforming to speculations, enterprise income tax was exempted within CNY 5 million, and was collected in a half way for the part exceeding CNY 5 million. (4) Investment tax incentives were offered for venture capital enterprises. Such investment shall enjoy the policy of deducting 70% of the investment amount as the amount of taxable income according to stipulations. The benefitted players were expanded from venture capital enterprises to their legal partners and individual investors, the investment objects were expanded from small and medium high-tech enterprises to science and technology enterprises in seed stage and startup stage. In addition, for university science and technology parks, and science and technology enterprise incubators (maker space) conforming to speculations, house property tax, urban and township land use tax and VAT were exempted. For self-use properties and lands of non-profit scientific research institutions, house property tax and urban and township land use tax were also exempted. For imported scientific research instrument and equipment of colleges and universities, scientific research institutions, and transformed scientific research institutions, import tariff and import VAT and consumption tax were exempted.

3 Deepen financial science and technology reform, and overcome system and mechanism obstacles

Over the past ten years, while enhancing investment strength and innovating support method, the finances also actively deepened financial science and technology reform, and broke system and mechanism obstacles influencing optimization and allocation of science and technology resources and vitality of scientific and technological innovation, so as to provide strong institutional guarantee for financial support for scientific and technological innovation.

3.1 Focus on making overall planning of science and technology resources and deepen the reform of government science and technology program management

Facing the problems of repeated, cross, closed and low-efficient allocation of science and technology resources, the central and local governments have successively reformed the government science and technology programs (special project, fund, etc.) management. At the central government level, in accordance with the requirement for focusing on national strategic goals, nearly 100 science and technology programs (special project, fund, etc.) scattered in 40 central departments were subjected to optimization, integration and system reorganization, and five categories of science and technology programs were formed, namely National Natural Science Foundation of China, National Major Special Science and Technology Projects, National Key Research and Development Programs, Technology Innovation Guidance Special Project (Fund), and Base and Talent Special Project, specifying their own missions and orientations. This has fundamentally changed the original problems of poor coordination, barriers between different departments and regions, and crossing and overlapping of science and technology programs, put tens of billions of stock capital into good use, and created a new allocation mechanism of science and technology resources conducive to coordinating all efforts to complete major missions. Moreover, an open and uniform national science and technology program management platform was established, making inter-ministerial joint...
conference review the layout of science and technology program and design the key research and development task, and the phenomenon of each department acting on its own was changed into joint governance through consultation. Scientific research projects and funds were under the management of special institutions instead of under the direct management of government departments, thus promoting the transformation of government function in science and technology management.

3.2 Deepen the reform of science and technology achievement use right, disposal right and income right management by means of “empowerment + benefit”

Regarding the problems of difficult transformation, low transformation rate of science and technology achievements, the central finance reformed the use right, disposal right and income right management of science and technology achievements. Twenty central-level public institutions were selected for pilot reform. The review and filing of science and technology achievement transformation by the competent department and financial department were cancelled, and the pilot units were allowed to independently decide transfer, license and external investment of science and technology achievements, and set up the market pricing mechanism of science and technology achievements. Yields from science and technology achievement transformation were all reserved by the belonging units for rewarding scientific researchers for their scientific research development and science and technology achievement transformation work. Pilot reform has achieved remarkable results, and the reform content was written into the Law of the People’s Republic of China on Promoting the Transformation of Scientific and Technological Achievements. To further deepen “three property right” reform (arising from China’s land reform: nontradable ownership, nontradable contractual rights and tradable land use rights), pilot reform of empowering the ownership or long-term use right of job-related science and technology achievements to researchers was also carried out. The above reforms have broken through management bottlenecks of science and technology achievement transformation, promoted combination of science and technology and economy, stimulated enthusiasm of researchers in transforming achievements, and improved application benefit of financial science and technology funds.

3.3 Deepen the reform of scientific research project fund and other management with “streamline administration and delegate power, improve regulation, and upgrade services” as the main line

For the problem of “too careful and rigid” “value things and despise personnel” in scientific research fund management as mostly reflected by the science and technology community, management reform was implemented. With “streamline administration and delegate power, improve regulation, and upgrade services” as the main line, such reform empowered autonomous right to colleges and universities, scientific research institutions and researchers in terms of project fund management, overseas management of business travel conference, procurement management of scientific instrument and equipment. Especially in scientific research project fund management, a series of “relaxation + incentive” reform measures were proposed to simplify the project budget planning, delegate to lower-level governments the power to regulate project budgets, increase the proportion of indirect costs, expand the scope of labor expenses, pilot implementation of overall rationing system of project fund, pilot implementation of withdrawing reward fund from stable support fund of scientific research, and retaining project balance for self-use instead of returning to the country. To reduce burden of researchers, we establish scientific research finance assistant system, improve financial reimbursement management system, promote paperless reimbursement pilot of scientific research fund, and simplify financial management for project acceptance and final settlement.

3.4 With clear rights and responsibilities as the goal, deepen reform of the division of fiscal authority and expenditure responsibility between central and local government in the field of science and technology

Making reasonable division of fiscal authority and expenditure responsibility between central and local government in the field of science and technology is a basic guarantee for governments in providing public science and technology services effectively, as well as an objective requirement for establishing a modern financial system, and promoting modernization of governance system and governance capability in the field of science and technology. Regarding the long-term problems of unclear division and crossing and overlapping fiscal authority and expenditure responsibility between central and local governments in the field of science and technology, reform was implemented. Central fiscal authority, local fiscal authority and central-local co-fiscal authority were defined from seven aspects: science and technology R&D, construction and development of scientific and technological innovation base, building of science and technology talent team, science and technology achievement transformation, establishment of regional scientific and technological innovation system, popularization of science and technology, reform and development of scientific research institutions. Further, central-local expenditure responsibilities were determined in accordance with the principle of expenditure responsibility should be assumed by the party of fiscal authority. Implementation of the reforms helps strengthen centralized leadership of the central government, improves socialist market economy, enhances
legalization management of the fiscal relationship between central and local governments, increases benefits from science and technology resource allocation, and promotes the development of scientific and technological innovation in a better way.

4 Outlook for development and reform of financial science and technology career in the future

In the face of new situation, new goal and new requirements, financial support for scientific and technological innovation are confronted with many new problems and challenges. On one hand, influenced by changes in domestic and foreign situations, the growth rate of financial revenue dropped, and the revenue-expenditure conflict was very sharp. On the other hand, the task of supporting scientific and technological innovation was very burdensome, and the demand for financial science and technology fund increased gradually. How to cope with the new problems and challenges is a major and difficult task for financial support of scientific and technological innovation in the next period. Looking to the future, in accordance with the deployment requirement of the CPC Central Committee for scientific and technological innovation, the finances shall keep close track with the new development trend of the new round of science and technology revolution and industrial revolution, make a correct judgment for the new international and domestic situations, and give full play to the role of financial function. Additionally, they should focus on making efforts in serving national strategy, improving policy efficiency, adjusting expenditure structure, and deepening reform, and make new contributions to implementing innovation-driven development strategy, realizing high-level sci-tech self-reliance and self-improvement, and building a powerful science and technology nation.

(1) Serve the national strategy and focus on key support points. Financial support for scientific and technological innovation must center on national strategic deployment and requirements closely, focus on major fields and key links of scientific and technological innovation, gather limited financial science and technology resources, and make accurate and continuous efforts. Emphasis should be laid on supporting the construction of national strategic science and technology force, on basic research, major public welfare research and key core technology R&D, on construction of high-level scientific and technological innovation talent and team, and on reform of science and technology system and mechanism.

(2) Optimize the policy system and promote policy transformation. We should lay emphasis on the system design of financial expenditure policy and preferential tax policy, enhance overall planning and coordination between the central and local governments and between relevant departments, and improve the precision and efficiency of implementation. Further, the finances should adjust to the new trend of scientific and technological innovation activities in the country from tracking and catching role to leading role, promote transformation of financial science and technology policy gradually, and highlight transformation from resource-driven and element-driven mode to innovation-driven mode, support of R&D activities, and support of basic research and applied research activities providing new knowledge.

(3) Maintain investment strength and adjust expenditure structure. The finances should always take scientific and technological innovation as the key area of financial investment, take financial investment in science and technology as national strategic investment, and develop mid-term investment plan of financial science and technology, which shall be completed according to their own capabilities, as well as by trying their best, to maintain continuous and powerful investment strength. Moreover, they should guide and drive the private investment in R&D, and form diversified science and technology investment pattern. Regarding long-term outstanding problems in expenditure structure, we should make real and practical efforts in adjusting the expenditure structure, and greatly improve the proportion of R&D expenditure in financial science and technology expenditure, and the proportion of basic research and applied research expenditure in the whole society’s R&D expenditure, maximally releasing the potential and efficiency of financial and the whole society’s funds for science and technology.

(4) Promote system reform and improve system construction. We should further promote reform of division of fiscal authority and expenditure responsibility between central and local governments in the field of science and technology, strengthen centralized leadership of the CPC Central Committee, enhance the central government’s authority for the planning of scientific and technological innovation policy, for major science and technology breakthrough, and for the establishment and layout of government scientific research institutions, government science and technology program and major scientific research base, to further solve the problems of poor coordination and each department acting on its own. Additionally, following the principle of making legal and efficient financial resource management and the law of scientific research, we should improve the systems relating to financial science and technology budget management, financial science and technology expenditure standard, and scientific research project fund and financial science and technology expenditure performance management.

References

1 Department of Social Science and Technology, and Cultural Statistics, Department of Strategy and Planning, Ministry of Science and Technology of the People’s Republic of China, National Bureau of Statistics.
ZHAO Lu Distinguished Researcher at Institutes of Science and Development, Chinese Academy of Sciences (CAS), former director of the Science and Education Division of the Ministry of Finance. He has been engaged in financial science and technology education for a long time and is mainly responsible for research and formulation of financial support for science and technology education policies, reform programs, budget management, and regulatory systems. Email: evayizhang@outlook.com