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Theoretical Basis of Science, Technology and State Budget Spending Management Mechanism for Science and Technology Activities

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Abstract
This paper systematically explores the fundamental theories of science and technology activities, clarifying the factors that influence their development. It also discusses theoretical issues related to state budget allocation for science and technology activities and the management mechanism for state budget spending on these activities. For the first time, it introduces criteria for classifying the content of the state budget management mechanism for science and technology activities, including: budget process management mechanism; spending method management mechanism; and fund model management mechanism. The paper also shares experiences on financial management mechanisms and state budgets for science and technology activities in various countries and regions worldwide, drawing lessons for Vietnam.

Keywords: Science, Technology, Management Mechanisms, State Budget Expenditure

1. Introduction

At the 6th session of the XIII National Assembly (2013) [1], the National Assembly passed the Science and Technology Law. This is the first time that the policy principles of the party and state in the field of science and technology have been formalized by the highest legal document of the state. To implement the Science and Technology Law, the government, prime minister, and related ministries and agencies have issued many legal documents, such as decrees, decisions, and circulars, to bring the Science and Technology Law to life.

The recent changes in policy mechanisms in the field of science and technology have demonstrated a strong, fundamental, comprehensive, and synchronized shift in management, operation, and organization. However, these changes have only managed to "unblock" science and technology during the transition phase without sufficiently "boosting" their activities. Therefore, despite some achievements, our country's science and technology activities still have many limitations and have not yet met the requirements to serve the country's renovation and development in the context of intense globalization. This is becoming an inevitable trend for world development in this new era—the era of the Industrial Revolution 4.0—with the important role of a knowledge-based economy.

In the management system for science and technology activities, financial management plays a crucial role. Finance is both a resource and a driving force for the development of science and technology. The appropriate allocation and distribution of financial resources is only one aspect of the issue; the other is the need for a suitable financial management mechanism built and implemented based on the characteristics of science and technology activities. Over time, following the policies of the party and state, financial investment in science and technology activities has significantly increased, especially from state budget sources. The financial management mechanism in general, and specifically the state budget expenditure management mechanism for science and technology activities, have gradually been innovated, overcoming difficulties in implementing science and technology activities. However, along with the development of the economy and society, the perfection of economic management mechanisms, and increasing demands for contributions from science and technology to the economy, both general financial management mechanisms and specific state budget expenditure management mechanisms for science and technology activities have revealed many limitations and inadequacies both theoretically and practically. This poses a need for further research to improve these mechanisms to enhance the effectiveness of state budget expenditures for science and technology activities.

2. Theoretical Basis

Concept of Science, Technology, and ST&I Activities

According to the ST&I Law (2013) [1], "science is a system of knowledge about phenomena, objects, and laws of nature". So, science includes a system of knowledge about the laws of matter and the movement of matter, the laws of nature, society, and thought. This knowledge system forms in history and continuously develops based on social practice. It distinguishes between two knowledge systems: experiential knowledge and scientific knowledge.

According to the Science and Technology Law (2013) [1], "technology is a solution, process, or technical secret, with or without tools, used to transform resources into products".

The 2013 Science and Technology Law provided a precise definition of science and technology activities. Accordingly, science and technology is a vast field, encompassing all activities related to "scientific research, experimental research and deployment, technology development, technology application, science and technology services, promoting initiatives, and other creative activities aimed at developing science and technology".

State Budget Allocation for Science and Technology Activities

- *Investment in the Development of Science and Technology*

Investment in the development of science and technology is an occasional expenditure aimed at building infrastructure and technical facilities for science and technology organizations, regardless of their economic components. This investment includes:

+ New construction, upgrades, and capacity enhancement of science and technology organizations including: laboratories, experimental workshops, experimental stations; analysis centers, testing, calibration, and conformity assessment; specialized design, manufacturing, and testing facilities; application and technology transfer facilities, standards-measurement-quality; intermediary organizations of the science and technology market;
+ Constructing a research and development area for high-tech zones;
+ Building information infrastructure, national databases, and statistics on science and technology;
+ Other investment activities serving the development of science and technology.

Investing in the development of science and technology is not merely about providing financial resources to maintain, consolidate, and develop physical facilities and equipment for scientific and technological organizations. It also plays a role in guiding and adjusting the development of scientific and technological activities towards certain goals.

- *Regular Expenditure for Science and Technology*

Regular expenditure for science and technology refers to recurring expenses that occur regularly, annually, usually represented through the structure of the following expenditure groups:

+ Funding for scientific and technological tasks, including direct expenditure for these tasks and for the management activities of the competent authority over these tasks, as well as funding for post-acceptance evaluations of these tasks;
+ Regular expenditure and routine tasks according to the functions of public scientific and technological organizations, as stipulated by laws on the autonomy and accountability mechanisms of these organizations;
+ Providing charter capital and additional funds for national state funds in the field of science and technology;
+ Enhancing the professional skills and expertise of our management and research staff through training and development, both domestically and abroad;
+ Purchasing scientific research results and developments; acquiring technology as per the legal regulations on technology transfer; supporting technology transfer and import;
+ Hiring domestic and international experts, consulting organizations; promoting the application of scientific and advancements;
+ Supporting the commercialization of scientific research results and technological developments, nurturing and innovating technology;
+ Spreading knowledge, conducting media activities, and statistics in science and technology; organizing domestic and international scientific conferences and seminars;
+ We're here to assist with registration and protection of intellectual property rights, standardization, measurement, and quality activities, as well as publicizing scientific research results; we also recognize and reward achievements in science and technology.
+ We support international integration activities in science and technology, such as international conferences and workshops; we help explore information about science and technology and technology suppliers abroad; we encourage participation in international science and technology events, forums, and organizations; we provide matching funds for international science and technology projects; and we ensure the operation of the network of science and technology representatives abroad.
+ Allocate resources for the maintenance, repair, and upkeep of physical and technical infrastructure, as well as equipment serving scientific and technological activities.

The Management Mechanism for State Budget Expenditures for Science and Technology Activities

State budget expenditure management mechanism is the totality of measures and forms of organization and management of the process of preparation, implementation, and settlement of state budget expenditures carried out by state management agencies for budget units. and the unit uses the budget to achieve set goals. From there, the mechanism for managing state budget expenditures for science and technology activities can be defined as follows: the mechanism for managing state budget expenditures for science and technology activities is the totality of measures and forms of organization and management of the preparation and implementation process. and finalize state budget expenditures for science and technology activities. In other words, the mechanism for managing state budget expenditures for science and technology activities includes the entire cycle of state budget expenditures for science and technology activities, from planning, making, and approving state budget estimates, assigning research tasks, and allocating funding, to the stage of acceptance, finalization, inspection, and supervision of the process of state budget expenditure for science and technology activities. Here, the subject managing state budget expenditure (who manages?) is the government, ministries, branches, and state authorities

at all levels. In particular, governments at all levels are assigned specific scope, responsibilities, and powers in state budget management in accordance with the decentralization of socio-economic management and the provisions of law. The objects of management (managing who?) are the units that estimate the state budget and the units that use the state budget, as well as the state budget expenditures for science and technology (what to manage). Management tools are the party's guidelines, the state's policies and laws on finance, and the state budget. The methods of managing state budget expenditures for science and technology are planning methods, economic methods, administrative methods, inspection, etc. The management goal is to improve the efficiency of state budget expenditures for science and technology and promote activities. Science, technology, and innovation contribute to the country's socio-economic development.

Contents of State Budget Spending Management Mechanism for Science and Technology Activities

Management mechanism for state budget expenditures for science and technology activities according to the budget cycle: management mechanism for state budget expenditures for science and technology activities is implemented according to the budget cycle. This cycle is carried out in a certain order prescribed by law and includes the following stages: making estimates, allocating estimates, organizing implementation, and finalizing the state budget. This cycle starts from the stage of determining the spending needs of units and science and technology organizations (estimation), to the stage of general synthesis to submit to the competent authority for approval (allocation of estimates), and finally the stage of implementation. Implementing and finalizing expenses (organizing implementation and finalizing).

Management mechanism for state budget expenditures for science and technology activities divided by spending method:

- The method of actual payment and actual payment depends on what actually arises. Accordingly, scientific research establishments are allocated funding according to norms to carry out research tasks as planned or at the request of the managing agency. Here, the research facility operates as an administrative unit, and research staff work as civil servants. That is, the state pays salaries, and research staff perform research tasks and report research results to the state. For this method, the expenditure management mechanism follows the steps of the budget cycle.
- Methods of lump sum payment and purchase of scientific research results in S&T activities.

Block spending is the assignment of financial autonomy to organizations and individuals in charge of science and technology tasks using funds approved by competent authorities, associated with responsibility for the results of assigned tasks. purpose of the request. The lump sum payment method includes lump sum expenditures for the final product and partial lump sum expenditures for science and technology tasks.

Mechanism for managing state budget expenditures for science and technology activities according to the Fund model Along with direct spending from the state budget for science and technology, many countries, including Vietnam, also establish science and technology development funds to carry out science and technology tasks. The sources of these funds are very diverse, possibly from the state budget or possibly from corporate sources. The purpose of the fund is to invest in the development of science and technology. Investment methods are also very diverse, consistent with the characteristics of science and technology activities. In Vietnam, the Law on Science and Technology passed by the National Assembly in 2013 stipulates four types of science and technology development funds, including: (1) the national science and technology development fund; (2) the science and technology development fund of ministries, provinces, and centrally run cities; (3) the enterprise science and technology development fund; and (4) the science and technology development fund of domestic organizations and individuals. At the same time, regarding investment in science and technology development, the law stipulates that the state budget investment in science and technology is used to fund the state's science and technology development funds according to regulations. Thus, among the four types of science and technology development funds mentioned above, the national science and technology development fund and the science and technology development funds of ministries, provinces, and centrally run cities are funded from the state budget. Up to now, there have been three national science and technology funds regulated by the law on science and technology, including the National Science and Technology Development Fund (Nafoted), the National Technology Innovation Fund (Natif), and the National High-Tech Venture Capital Fund. These funds are provided with charter capital by the state budget to operate. The financial management mechanism for these funds also has its own characteristics. Financial inspection and supervision mechanisms in science and technology activities. The financial inspection and supervision mechanism in science and technology activities is the totality of methods, forms, and tools established to check and supervise the mobilization, distribution, and use of financial resources in the field of science and technology to ensure the right goals and efficiency. Inspection is "examining the actual situation to evaluate and comment", to refer to the subject's activities affecting the object of inspection (which may or may not be affiliated). Supervision refers to a comprehensive review activity of an entity outside the system with respect to an object belonging to another system, that is, between a supervisory agency and an agency subject to supervision that is not within a system. vertically dependent on each other. Financial inspection and supervision in science and technology activities can include checking constitutionality and legality, inspection and supervision of all levels in the system, checking and monitoring whether organizations and individuals providing science and technology products meet order requirements, etc.

3. Factors Affecting State Budget Spending on Science and Technology Activities

Objective factors

1. Socio-economic conditions and public financial resources capacity

State budget expenditure management is influenced by socio-economic conditions. With a stable economic environment, state budget revenue will be provided in full and on schedule. On the contrary, the economy is unstable, economic growth is slow, revenue is reduced, and state budget expenditures are reduced. Inflation also causes prices

to increase, causing demand to increase. Therefore, it can be said that socio-economic factors have a significant impact on state budget expenditure management.

2. Policy mechanisms and state regulations on state budget expenditure management

In a market economy with state regulation, the law has become an indispensable part of state management in general and state budget expenditure management in particular. The legal system, whose role is to guide and create conditions for economic sectors in society to operate in an orderly manner within the legal framework to ensure fairness, safety, and efficiency, is required to be very complete. Normative and uniform. Therefore, the legal system and policies related to state budget expenditure management will have the effect of restraining or promoting effective management of state budget expenditure.

Subjective factors

1. Management capacity of leaders and professional qualifications of the team of ministries in the state budget expenditure management apparatus

Management capacity of leaders of the state budget spending apparatus, including: capacity to build and organize the implementation of specific and clear spending plans; create a reasonable and effective organizational structure, with a clear division of responsibilities and deadlines among employees, between stages and parts of the state budget expenditure management apparatus. If the leader's capacity is weak, the organizational structure is unreasonable, and the strategies are not consistent with reality, the management of public financial resources will be ineffective, easily causing spending to exceed revenue. scattered investment spending, unreasonable division of regular spending can lead to loss and waste of budget, not promoting economic development, ensuring social problems.

2. Organizing the State Budget Expenditure Management Apparatus

Whether state budget expenditure management activities are implemented smoothly and effectively depends greatly on the organization of the expenditure management apparatus and professional processes, especially the management professional processes. The organization of the management apparatus and process, the powers and responsibilities of each stage, each department, and the relationship of each department in the process of implementing, executing, finalizing, and auditing state budget expenditures have an impact. Very important to the management of state budget expenditures. Organizing a suitable management apparatus will improve management quality and limit violations in management. The more scientific and clear the management process is, the more important it is to contribute to improving the quality of information at the decision-making level for state budget expenditure management and reducing information distortion factors. From there, the efficiency of state budget expenditure management can be improved.

3. State budget spending management technology

Reality has proven that the application of modern technology in state budget expenditure management will help save work processing time and ensure accuracy, speed, and consistency in data, creating a premise for effective operational reform processes. For that reason, modern technology is one of the important factors affecting the effectiveness of state budget expenditure management.

4. Factors associated with characteristics of S&T activities

The mechanism for managing state budget expenditures for science and technology activities, in addition to being influenced by general objective and subjective factors as mentioned above, is also influenced by the characteristics of science and technology activities, the characteristics of state budget expenditures, and the characteristics of state budget expenditures. for S&T activities. Therefore, the development and implementation of a state budget spending management mechanism for science and technology activities requires attention and reliance on these characteristics. For example, S&T topics and projects are products of knowledge and creativity, so regulations on spending norms based on working days and working hours are only relative and must be based on many criteria. different, such as academic title, degree, seniority in research work, etc. These factors are very important for the results and effectiveness of state budget expenditure management for science and technology activities.

4. International Experience on State Budget Spending Management Mechanisms for Science and Technology Activities

State budget expenditure management mechanisms for public research organizations in OECD countries

1. Contract Funding

Funding is a mechanism by which a government or budget allocation agency allocates an annual amount of funding to a research agency unconditionally, regardless of the specific project or program and the research agency. Have full rights to use the funds as they wish. In the UK, research institutes are funded on the basis of proving their research capacity through a research capacity assessment process.

2. Budget Allocation by Project

The project-based budget allocation mechanism is implemented to meet the requirements for transparency and accountability in public sector spending on science and technology. State budget expenditures for scientific research are increasingly oriented towards performing tasks on the basis of contracts and output criteria. In the long term, the funding mechanism will gradually decrease, replaced by a contract allocation mechanism with a definite term and allocation according to specific research programs. This mechanism was initially very popular in America, then became very popular in Europe and Asia. By linking budget allocations to specific goals, the project-based allocation mechanism overcomes the rigidity of the research system in many OECD countries and promotes funding for new scientific fields that bring interdisciplinarity, which is a priority area for countries.

Table 1: Summary of funding mechanisms for scientific research in some countries

S. No	Country	Funding Source
1.	Canada	Science and Technology funding is distributed through the budget for various departments and agencies, there's no separate budget for Science and Technology.
2.	Germany	About 750 public research organizations are funded by the Federal Government and the Lander Institute according to a pre-agreed formula.
3.	South Korea	The private sector contributes significantly, focusing on applied research and development. The government aims to distribute a portion of the R&D budget of government research institutes to independent researchers to encourage their creativity and support the invention of technological seeds.
4.	Norway	The Norwegian Research Council is responsible for allocating funds to most research institutes.
5.	Spain	The salaries and regular expenses of public research institutes are primarily funded by the central government and regional authorities. R&D activities are mainly financed through the public competitive mechanisms of regional, national, and international R&D programs. Only a small portion of the budget comes from contracts with businesses.

Source: Compiled by the authors

Financial Mechanism for Public Research Institutions in Korea (GRI)

Government-funded Research Institutes (GRI): These are semi-autonomous research centers established by the South Korean government, with a total of 100 institutes, 52 of which are in the field of social sciences and humanities. The GRI's funding comes from both the national budget (about 50% of the total operating budget) and other sources through research contracts. However, in the 1980s, the GRIs were criticized by the business community and the government for not meeting the needs of the business sector, with their scientific tasks often overlapping and being inefficient. Based on this, the government has restructured some GRIs to enhance their capabilities, and since 1996, it has applied a project management system instead of the previous lump-sum mechanism to improve the research capabilities of the GRIs.

Financial Mechanisms for Public Research Organizations in China

The state guides and develops according to goals, along with appropriate policies consistent with economic policies and innovative reforms. Mobilizing suitable resources: China has aimed for changes not only in innovative elements such as research institutes or educational organizations but also in strengthening the innovative environment. Simultaneously, these resources have shaped the core of China's science and technology policy and innovative reforms. Organizing and managing R&D and technology: The emergence of new technologies is essentially multi-sectoral.

Lessons Vietnam can Learn from the Experience of Building a Management Mechanism for Scientific and Technological Activities in Some Countries

Firstly, funding sources for research are becoming increasingly diverse. Besides the state budget, the proportion of funds from collaborations with the business sector, foreign cooperation, or public-private partnership models is on the rise.

The second, the mechanism of budget allocation through competition is a strategy many countries have successfully implemented, although it does have some drawbacks that need to be addressed. At the same time, the trend of organizing public research institutes in a business-oriented manner will be a future trend, associated with accurately calculating all research costs into the product price and research service.

Thirdly, in the field of budget allocation for science and technology, the general trend is gradually replacing the method of total budget allocation with partial allocation and a portion that varies depending on the project or research results.

5. Conclusion

In reality, countries with strong economies are those with particularly advanced science and technology sectors. For these sectors to fully leverage their crucial roles, the financial mechanism must be continuously refined to meet management requirements at each development stage, especially in today's industrial revolution. Using various research methods, this paper focuses on the management of state budget expenditures for science and technology activities in two ways: both through the budget process and through the organization of research activities. The paper presents some theoretical issues about scientific and technological activities and the management of state budget expenditures for these activities. At the same time, it introduces experiences in financial management and state budget for science and technology activities in some countries around the world and regions, drawing lessons for Vietnam.

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