SCIENCE AND TECHNOLOGY POLICY IN THE PROCESS OF INDUSTRIALIZATION OF THE COUNTRY: EXPERIENCES FROM SOME COUNTRIES AND THE CURRENT SITUATION IN VIETNAM

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Summary:

The studies on the process of promoting industrialization of countries in the East Asian region all have the same opinion about the role and contribution of science and technology (S&T) policy in accelerating the process of catching up with the industrialized countries, not only in terms of products, goods, and services but also in improving the capacity and level of national S&T. Vietnam's S&T policy in recent years has also been oriented to contribute to the process of industrialization of the country. Although Vietnam's S&T policy system has had certain positive impacts on the country's development process, there are still certain barriers and challenges. This article provides some comparisons between S&T policy in the industrialization process of 03 countries (Japan, Korea, China) and Vietnam's S&T policy in recent times, thereby proposing some suggestions to improve the policy in the coming time.

Keywords*: Science and technology; Policy; Technology import; Science and Technology human resources.*

Code*: 24040501*

1. Science and Technology Policy

S&T policy, according to Lundvall et al. (2005), is the government intervention in the economy to support scientific discoveries and the development of technological solutions. Rigas Arvanitis (2009) defines: "*S&T policy includes measures by the public sector/Government to generate, finance, support and mobilize S&T resources. S&T policies cover a wide range of knowledge production activities. They include public and private sector activities, research as well as production activities. The scope, objectives, targets, and mechanisms of S&T policy change over time"*. Accordingly, for a long time, science and technology policy has been viewed by governments of many countries as a focus on state intervention to promote the development of new knowledge sources, serving economic, and social development, national defense, and security through research and development (R&D) activities of universities, research institutions and enterprises.

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2. Science and technology policies in the industrialization period of some countries

The effective development and implementation of science and technology policies by the governments of Japan, South Korea, and most recently China have created an important foundation for these countries to successfully carry out structural transformation and long-term productivity growth to maintain economic development and thereby successfully carry out the industrialization process. Chaminade and Lundvall (2019); Yun (2007); KDI and DSI (2012); and OECD (2008) have summarized the characteristics of science and technology policies of these countries in the industrialization period as follows:

2.1. Japan (1945 - 1970)

Japan's economy and industry suffered great losses during World War II. The main goal of S&T policy in the postwar period was to facilitate industrial recovery and economic growth. Starting from the 1960s, S&T policy also supported social outcomes. The selection of specific technology areas was pursued in the 1960s and 1970s such as finding solutions to problems of pollution, traffic congestion, and water scarcity. Japan's strategic goal during this period was to narrow the technological and economic gap with the United States.

- *Importing industrial technology*

After World War II, modern technology for industrial development was imported from advanced economies. Industrial production grew at an annual rate of more than 20% in the late 1950s, and Japan's automobile and electronics industries achieved global success. Japanese companies also innovated and improved imported technology, leading to the development of several new products.

- *Private sector-led research and development investment*

The above Indigenous technological improvements were made by private companies, investing in R&D. Private companies established in-house research laboratories called “central research laboratories”. While some technological advances were made through Japan's technology development efforts, industrial laboratories focused mainly on improving existing or imported technologies. Their efforts were supported by policies of the Ministry of International Trade and Industry. Initially, they protected infant industries from foreign competition and supported exports until producers developed the capacity to face global competition.

- *Strengthening the organizational framework and investment in science, technology, and innovation*

In the 1950s, a comprehensive administrative organization for science and technology was established at the request of the Japan Business Federation. In 1956, the Japan Science and Technology Agency was established in the Prime Minister's Office to promote research, reduce the dependence on foreign technology, and strengthen linkages between the research sector and industry. In 1959, the Science

and Technology Council was established to guide comprehensive national science and technology policy.

In the mid-1960s, the focus shifted to developing indigenous technological capabilities. The government had to invest in developing research capabilities. In 1966, to create technological breakthroughs and spillover effects, the government launched the "large-scale industrial research and development system," known as the "big project," which funded the costs and bore the risks of large-scale industrial research activities. The government selected the priority areas, subsidized private companies to develop technology, and directed the efforts of private enterprises, universities, and national laboratories toward promising industries.

- *Human resource development*

Human capital was an important factor in supporting the postwar economy. Compulsory education was extended to junior high schools that provided vocational education. The government also expanded and improved higher education.

2.2. South Korea (1960s - 1990s)

In the 1960s, South Korea's policy shifted to a high-growth, industrialization-oriented, export-led strategy, leading to economic growth. The export-led policy put pressure on domestic firms to improve productivity and maintain competitiveness in international markets, and this pressure pushed them to accelerate technological learning. Economic growth continued to accelerate in the 1970s. The growth of heavy and chemical industries led to diversification and increased demand for technology. South Korea overcame some of its economic challenges by developing domestic R&D capabilities to sustain high economic growth in the 1980s.

2.2.1. Importing production materials, licensing technology, and contracting original equipment manufacturing to build industrial capacity

As a latecomer, Korea has known how to take its "latecomer advantage" to collect and accumulate information, especially technological information from developed countries to support production and business activities in industrial sectors. During this period, Korea has formed a strategy, accordingly, on the one hand, focusing resources on importing technology and equipment, prioritizing technologies from Japan and the United States, on the other hand, to quickly absorb, and move towards technological autonomy in the shortest time, policies to support research and development in industrial activities and promote the dissemination and diffusion of technology have also been implemented synchronously. Regarding technology and equipment imports, during the period from 1962 to 1986, Korea received them from abroad through the following channels: (i) Foreign direct investment with a total value of 3.6 billion USD, of which the United States and Japan accounted for more than 80%; (ii) Technology franchising with a value of 1.75 billion USD, of which the United States and Japan accounted for 75%; (iii) Imports of equipment and machinery attached to technology reached 126.4 billion USD, of which imports from the United States and Japan accounted for 50% *(Yun. 2007)*.

To facilitate the acquisition and move towards technological autonomy in priority industries, Korea has established a series of national programs with multi-faceted support from the Government, specifically:

- Industrial Generic Technology Development Program to mobilize the participation of research facilities, and laboratories in conjunction with industrial enterprises to research technologies with common features to move towards import substitution. This program focuses on replacing imported source technology from Japan in the fields of electronics and industrial machinery;
- The National R&D Program focuses on researching and solving technological issues that Korea has not yet mastered. The goal of this Program is to localize industrial machine parts and components in the long term, develop new materials, design semiconductors, develop microcomputers, and energy-saving technologies, localize nuclear fuel sources, etc.;
- The Highly Advanced National R&D Program aims to raise Korea's technological capacity to the level of G7 countries (that's why this Program is also called G-7). The contents of this Program include 2 parts: projects to develop product technology (for example: chemicals, new pharmaceuticals, HD TV, digital content service systems combined with broadband, etc.); projects to develop key technologies (for example: developing VLSI ultra-large integrated circuits, modern manufacturing systems, environmental technology, new functional biological materials, etc.). Thanks to this Program, Korea has become self-sufficient in technology to create products such as HD TV or DRAM;
- The World Class Korean Products Program focuses on supporting 59 enterprises to develop and improve the quality of 27 selected products. Through this Program, the Government will provide financial support and other incentives to improve the quality and competitiveness of Korean-branded products through the application of new technologies and marketing strategies in the international market;
- The New Technology Commercialization Program aims to provide financial support for R&D activities and commercialization of technologies developed by Korea. These technologies are certified by the Government as “Korean Technology” or “New Technology”;
- The Spin-off support program includes financial, management, and technical support for researchers and individuals with technological inventions to start new businesses.

2.2.2. Building a network to support technology dissemination

The dissemination of imported, adapted, and mastered technologies among enterprises and within the industry plays an equally important role in the promotion of technology import and mastery. If a business holds technology alone, it will only bring initial advantages due to monopoly, but in the long run, it will not bring many economic benefits or contribute to the development of the industry's technological capacity.

The Korean government has also made necessary interventions to create channels for technology dissemination instead of the habit of appropriating and monopolizing technology exploitation by enterprises. This intervention has created an environment for technology learning and healthy competition among enterprises in the industries. In 1973, Korea enacted the Engineering Service Promotion Law. According to this Act, projects related to technical and technological consultancy, regardless of whether the investor is foreign or domestic, must give priority to signing contracts with domestic technical consultancy companies first, and foreign consulting companies, if any, will only play a secondary role. The main purpose of this Act is to create conditions and incentives for domestic technical consultancy companies to quickly learn from the experience of foreign colleagues to have enough capacity to perform assigned tasks in the country. By the 1980s, the Government had formed a network with the participation of state organizations, public research institutes, and enterprise research institutes with the function of supporting enterprises in popularizing technology. This network includes the Government's Agency for Industrial Advancement, the National Institute of Industrial Technology, the Productivity Center, the Industrial Product Design and Packaging Institute, the Korean Standards Association, the Industrial Enterprise Research Institute, Korea Institute of Science and Technology (KIST), Korea Institute of Machine and Tool Manufacturing (KIMM)...

2.2.3. Investment in domestic research and development, institutional building

In the late 1970s, the policy focus shifted to building domestic technological capacity to maintain industrial competitiveness. Technological protectionism in advanced economies and the penetration of increasingly sophisticated technology were the main drivers of this change. Both the government and corporations began to invest in technological development. Private companies began to engage in R&D activities with government support and participated in many national R&D projects promoted by the government.

One of the objectives of the Ministry of Science and Technology was to provide government R&D support for science and technology. Five strategic heavy industries were identified: machinery, steel, shipbuilding, electronics, and chemicals. Government-funded research institutes were established to develop the technological capacity needed for the heavy and chemical industries. They subsidized the high-cost, high-risk R&D undertaken by the chaebol (corporate tycoons) in these industries. Initially, the government bore the bulk of R&D spending.

In the 1980s, the national R&D system was reorganized to invest more in state resources and to increase the role of the private sector. The Ministry of Science and Technology supported the establishment of company-affiliated research institutes. Industrial technology research associations were established in each industrial sector to pool technology, human resources, funds, and research facilities to overcome common barriers to developing advanced, competitive technologies. This movement led to the development of a variety of technologies, including semiconductors. The government also began to build a broad network of public, nonprofit, and private

technical support organizations to disseminate technology, especially to small and medium-sized enterprises.

In the 1990s, science and technology policy promoted a more robust private-sector-led technological innovation system. In the early 1990s, in contrast to previous decades, 70-80% of total R&D was funded by the private sector. The number of corporate research institutes, which started at 46 in 1981, increased to 1,000 in 1991 and to 4,810 in 1999.

As private sector R&D capacity increased, the government promoted large-scale national R&D projects, funded basic research, and developed university research capacity to move away from imitative strategies and strengthen domestic technological capabilities. Government-funded research institutes reflected these changes. With the increasing development of specialized technology, by the mid-1990s, most ministries were involved in S&T management, and a system was established to plan and promote independent national R&D projects within each ministry. In 2002, the Ministry of Science and Technology was formed from the State Science Commission, and the National Science and Technology Council was established.

2.2.4. Strengthening the human resources of science and technology

Achieving high rates of industrialization requires an educated workforce. Public and private spending on education has led to a rapid increase in education at all levels. The college/university graduation rate increased from less than 20 per 1,000 people in 1960 to more than 300 per 1,000 in 1994. A long-term science and technology human resource policy was adopted to support the development of heavy and chemical industries. Under this policy, specialized human resources were provided according to industry and human resource levels. As a result, the number of students in science and technology universities increased from 46,671 in 1970 to 139,300 in 1980; the number of college students increased from 6,945 to 40,880 in the same period. In 1971, the Korea Advanced Institute of Science was established to train advanced science and technology personnel with practical skills specifically suited to the industrial and defense sectors. In 1981, this educational institution merged with the Korea Institute of Science and Technology to become the Korea Advanced Institute of Science and Technology to strengthen the link between education and research. In addition, the government promoted the establishment of science high schools, increased support for basic scientific research activities at universities, expanded military exemptions for science and engineering graduates, and increased research scholarships. The establishment of the National Research Foundation and government research institutes were also important in developing a strong R&D workforce. The government also pursued a policy of attracting Korean scientists and engineers from overseas. From 1968 to 1990, more than 1,000 long-term repatriated and 1,000 temporary repatriated scientists and engineers were supported.

The R&D activities of universities accelerated in the 1990s when various projects and systems were implemented to support them. Many provincial-level schools and medium- and small-sized universities were established. Graduate schools also

expanded significantly, increasing from 303 in 1990 to 905 in 2000. During the catch-up and industrialization period (1960-1999), the economy grew at an average annual rate of 9%, raising per capita GNP (current prices) from $87 in 1962 to $10,550 in 1997. The country's export value increased from $40 million in 1963 to $143 billion in 1999, with the share of manufactured goods in exports increasing from 17.6 to 91.5% over the same period.

2.3. China (1978 - 2012)

China is a country that pursues a catch-up strategy to industrialize the country, which has many similarities with the way Japan and South Korea have done.

2.3.1. Importing technology and equipment

In the 1980s, along with economic reform, China shifted its technology import policy to focus on upgrading the technology of existing enterprises. To serve this new policy, the National Economic Commission formulated and implemented a program to reform existing enterprises with imported technology within the scope of the 6th Five-Year Plan (1980-1985). The basic reason for this new policy can be seen as an effort to reduce the inefficiency of the central planning system. However, the direct cause for implementing this policy was the failure of the overly ambitious economic development policy of 1978, characterized by many contracts for importing entire factories. The government identified several shortcomings in previous policies: (i) over-reliance on imports of all equipment and inefficiencies in importing entire projects; (ii) neglect of software, such as patents, know-how, and technical documents, in technology imports; and (iii) neglect of updating the technology that existing enterprises had (*Conroy, 1986*).

According to the new policy, technology imported into China since the early 1980s was divided into two groups. *First*, the construction of new and large factories with the technology import was carried out by the State Planning Commission, and investment in these projects was made through capital construction projects. *Second*, imported technology, used to upgrade state-owned enterprises, must be managed by the State Economic Commission and investment in these projects was arranged from technology innovation projects. The plan for technology import and innovation is based on the five-year plan, industrial development programs, and state funding programs.

Once the budget for technology innovation is decided, it will be allocated to localities and ministries according to the economic development strategy and the interests of the localities and ministries. Localities develop their technology innovation plans by themself, including projects financed by both central and local funding, including foreign currency. In return, enterprises can also use their retained profits and foreign currency earnings to finance technology import projects. Therefore, technology innovation projects using imported technology are often funded by a combination of sources from the state, localities, and enterprises, although there are projects funded mainly by one of these sources.

2.3.2. Linking research and development activities with business activities

According to OECD (2008), China has identified five major adjustments in policies and investments for science and technology linked to business activities, including:

- Linking economic policies and science and technology policies to ensure that businesses can access state investment sources for R&D;
- Reforming science and technology programs to allow businesses to carry out national R&D tasks;
- Improving the technology transfer mechanism to facilitate the integration and application of technology in industrial production;
- Accelerating the establishment of a modern enterprise system to enhance the strength of business technological innovation;
- Creating a good innovation environment to promote innovation activities in small and medium-sized enterprises (SMEs).

2.3.3. Reorganization of the R&D system.

Since 1978, when China began to implement market-driven reforms and open its economy, the innovation system has changed rapidly. Enterprises have reorganized and added some functions such as R&D and marketing, thereby significantly increasing the innovation capacity of enterprises.

During this period, public research institutes played an important role in research activities, accounting for half of the total number of R&D organizations in China by 1987. However, apart from only a few large universities such as Tsinghua University and Peking University, most universities did not conduct scientific research activities. Even more, apart from the large multidisciplinary universities, most specialized universities only focus on the technology for specific industries and the education for industries such as light industry, metallurgy, chemistry, etc. Their research activities only focus on the application of specific technologies.

After the 1978 reform, the S&T system was exposed to a competitive open market. Therefore, the reform goals for S&T were set as follows: establishing a new management system for S&T to commercialize new ideas; and create competition in research institutes and funding systems. This is an important initiative related to reforming the financial resource allocation system and making management at research institutes more flexible. The government will cut funding for public research institutes, but funding from other sources or private sources will increase. This will increase the pressure on scientists and the results of research projects will be shortened and the economic value will increase.

To speed up the process from research to commercial production, first, the government has encouraged research institutes and universities to establish their spin-off enterprises, and scientists temporarily leave their research positions and engage in commercial activities. Second, the government has created a new "playground" for S&T activities called the technical market, to create the

opportunity for technology suppliers and users to meet and participate in technology transfer transactions. Third, special economic zones have been established across the country to support the development of high-tech companies. In 1988, the State approved and established the Beijing New Technology Experimental Development Zone. By the end of 1992, 52 national high-tech and new-technology development zones had been established in China. In 1993, 9,687 high-tech enterprises were registered in these zones.

In the 1990s, the Chinese government realized that there was still a large gap between the research activities of research institutes and the actual real needs of industry. Faced with this challenge, in 1998, the State Council decided to transform 242 national research institutes into technology-based enterprises technology service units, or departments of enterprises.

In this trend, research institutes no longer dominate China's innovation system, and enterprises have gradually become a core part of the innovation system. Since 2000, enterprises have made more than 60% of total R&D investment. Nevertheless, the role of research institutes and universities in scientific research and pioneering technological research remains irreplaceable.

2.3.4. Attracting talents and high-quality human resources from abroad

At the beginning of the reform and opening of the economy, the Chinese domestic science and technology capacity was low and was far behind other countries. Therefore, China sent its students to other countries to study abroad to train high-quality human resources in science and technology. These international students will receive support from the Government to study abroad, and on the other hand, the Government has many measures to encourage domestic and foreign talents to work in China. The China Scholarship Council is one of the units responsible for organizing, supporting, and managing Chinese people who go abroad to study and do research as well as foreigners who come to China to work; and strengthening cooperation activities between China and other countries in the fields of education, science and technology, culture, trade, etc. From 1978 to 2007, 121,170,000 people went abroad to study and research, of which only 31,970,000 returned to China to work. China is trying to create a positive environment for returnees, hoping that the number of returnees will continue to increase.

Brain drain is a problem that developing countries are facing. These countries are looking for ways to try to create opportunities for researchers and scientists with the hope of attracting human resources back. China has implemented various policies to attract human resources back after being trained in developed countries. China has invested heavily in establishing laboratories and research facilities. China has successfully funded scholarships for overseas study and imported foreign talents, and these experiences are valuable for other developing countries to refer to and implement. China has introduced many financial incentives as well as other supports for scientists such as high salaries, cultural support, and income supplements from government-sponsored projects.

3. Vietnam's Science and Technology Policy

Vietnam's Socio-Economic Development Strategy for the 2021-2030 period sets the goal that by 2030, Vietnam will be "*a developing country with modern industry and high average income; with a modern, competitive, effective and efficient management system; a dynamic, fast and sustainable economic development, independent and self-reliant based on science, technology, innovation associated with improving the effectiveness of foreign affairs and international integration*".

According to the development orientation in the next 10 years, Vietnam can now be considered in the process of completing the country's industrialization goals. Accordingly, some characteristics of the S&T policy in the recent period can be identified as follows:

3.1. Forming institutions for science and technology activities

Vietnam has developed and promulgated 05 major laws that directly impact science and technology activities:

- Law on Science and Technology (2000, amended in 2013) creates a basic legal foundation for scientific research and technology development activities of organizations and individuals; affirms the Vietnamese Government's focused and key investment interest in science and technology (ensuring that the investment level from the state budget reaches 2% per year);
- Law on Intellectual Property (2005) creates a legal framework for the protection of intellectual property rights for the forces, participating in innovation activities; creates necessary support conditions for the development of intellectual property in science and technology organizations and the business sector;
- The Law on Technology Transfer (2006) establishes necessary regulations to implement technology transfer based on compliance with intellectual property regulations; establishes corridors for the technology that are encouraged and discouraged from transferring from abroad to Vietnam and vice versa; grants the right to use, ownership and the forms of profit sharing for research results using the state budget; incentive mechanisms and policies to promote technology transfer and innovation in enterprises through tax, credit, land incentives and especially the National Technology Innovation Fund establishment;
- The Law on Standards and Technical Regulations (2006) and the Law on Product and Goods Quality (2007) provide necessary legal regulations on standards and quality for products and goods of enterprises manufacturing in Vietnam; establish supporting mechanisms to motivate Vietnamese enterprises to improve productivity, quality, and competitiveness through S&T activities and innovation;
- The Law on High Technology (2008) demonstrates Vietnam's determination to strongly develop high-tech sectors to enhance national competitiveness through efforts to increase investment; preferential mechanisms and incentives for high-tech development activities, especially for highly qualified human resources.

Based on the promulgated laws in the field of science and technology, the organizational system serving state management and performing the state management functions has also been improved and consolidated:

- Decree No. 122/2003/ND-CP dated October 22, 2003, of the Government establishing the National Foundation for Science and Technology Development;
- Decision No. 393/2006/QD-TTg dated March 13, 2006, of the Prime Minister establishing the State Agency of Technology Innovation;
- Decision No. 2658/2006/QD-BKHCN dated December 8, 2006, of the Minister of Science and Technology establishing the Office of State-level Key Science and Technology Programs;
- Decision No. 890/QD-TTg dated June 8, 2011, of the Prime Minister establishing the National Agency for Technology Entrepreneurship and Commercialization Development;
- Decision No. 1342/QD-TTg dated August 5, 2011, of the Prime Minister establishing the National Technology Innovation Fund.

3.2. Innovation of science and technology management mechanism

On September 28, 2004, the Prime Minister issued Decision No. 171/2004/QD-TTg approving the Project on reformation of science and technology management mechanism. The Project identifies the following innovation contents:

- *Improving the mechanism for building and organizing the implementation of science and technology tasks:* Assigning and decentralizing tasks in building organizing and implementing the science and technology tasks; Perfecting the mechanism for building organizing and implementing the State's science and technology tasks; Quickly applying the science and technology research results to production reality and life;
- *Reforming the management and operation mechanism of science and technology organizations:* Implement the mechanism of autonomy and self-responsibility for state science and technology organizations engaged in basic research, strategic and policy research, research in key science and technology fields, and some other fields prescribed by the State (including Autonomy in science and technology activities; Autonomy in finance; Autonomy in personnel management; Autonomy in international cooperation); Transform applied research and technology development organizations into the organization, operating under the enterprise mechanism; Promote the formation and development of high-tech science and technology enterprises; Promote the research functions and improve the effectiveness of science and technology research of universities;
- *Reforming the mechanism and policies on financial investment for science and technology activities:* Diversify the capital investment sources for science and technology; Reform investment policies and mechanisms of the state budget

allocated for science and technology activities; Improve the mechanism for using financial resources to create motivation for science and technology activities;

- *Reforming the mechanism for managing human resources in science and technology:* Increasing the autonomy of science and technology organizations in human resource management; Building mechanisms and policies to motivate science and technology staff; Strengthening training and retraining of science and technology staff; Attracting foreign experts to serve the science and technology development. Issuing policies to attract Vietnamese talented experts and foreign experts to participate in training research staff, teaching, consulting, and holding positions in science and technology research management in Vietnam;
- *Developing technology markets:* Linking the reformation of the economic, and social mechanisms and policies with promoting science and technology progress and applying science and technology achievements to production and life; Improving the quality and commercialization ability of science and technology products; Developing intermediary and technology brokerage organizations; Perfecting and enhancing the effectiveness of laws on intellectual property and technology transfer;
- *Perfecting the operating mechanism of the state management apparatus on science and technology:* Carrying out administrative reforms in the state management agency on science and technology, orienting towards focusing on the state management task, separating professional career tasks from administrative agencies, strengthening the monitoring and inspection functions. Promoting training and improving the qualifications level and capability of the state management staff on science and technology. Strengthening the Government's coordination to create linkages between science and technology activities with the economic, social, defense, and security activities. Implementing clear assignment and decentralization of tasks, authority, and responsibilities for science and technology management among ministries, ministerial-level agencies, government agencies, provincial people's committees, and centrally-run cities. Clearly defining the functions and tasks of state management agencies on science and technology.

3.3. Promote science and technology activities in enterprises

Support enterprises producing main products, key products, and national products to master and apply new technologies, and advanced technologies, and support small and medium-sized enterprises to innovate technology. The Prime Minister has approved the National Technology Innovation Program until 2020 (Decision No. 677/QD-TTg dated May 10, 2011) to implement the following contents:

+ Develop and implement a roadmap to improve national technology capacity;
+ Research, master, and apply advanced technologies in the production of main products, key products, and national products;
+ Support small and medium-sized enterprises to innovate technology;

+ Increase resources for technology innovation in rural, mountainous areas, areas with difficult socio-economic conditions, and areas with especially difficult socio-economic conditions.

Promote the development of Vietnamese-owned branded products with advanced technology, that are competition-capable in terms of novelty, quality, and price based on exploiting the comparative advantages of human resources, resources, and natural conditions of the country; enhance technology transfer, acquisition, mastery, and application of technology in key economic - technical and industrial sectors; improve the technological innovation capacity of enterprises and national technological potential. The Prime Minister has approved the National Product Development Program until 2020 (Decision No. 2441/QD-TTg dated December 31, 2010) focusing on implementing the following contents: Research and development of national products; Trial production of national products, forming pioneering enterprises in producing national products; Commercialization of products and market development, forming economic - technical sectors based on national products.

High-tech development: The Prime Minister has approved the National High-tech Development Program until 2020 (Decision No. 2457/QD-TTg dated December 31, 2010) with the contents focusing on developing high-tech applications agriculture; some high-tech industries; researching, training, and constructing the high-tech technical infrastructure.

3.4. Promoting technology transfer and import from abroad

In 2018, the Prime Minister approved the Project to promote technology transfer, mastery, and development from abroad into Vietnam in priority sectors and fields for the period up to 2025, with a vision to 2030 (Decision No. 1851/QD-TTg dated December 27, 2018). The Project focuses on the following objectives:

Perfecting mechanisms and policies to facilitate the transfer, mastery, and development of technology from abroad into Vietnam, contributing to promoting in-depth growth model transformation;

Focusing on developing several priority sectors: information and communications, industry, agriculture, construction, transportation, health, natural resources, and environment; in which focusing on several areas: information technology industry, electronics industry; mechanical engineering; high-tech agriculture; preservation and processing of agricultural, forestry and aquatic products; construction, transport, and infrastructure technology; environmental, and climate change response technology; pharmaceuticals, disease diagnosis and treatment technology; Improving the technological capacity of the organizations and enterprises, serving the technology transfer, mastery and development from abroad to Vietnam.

In 2023, the Minister of Science and Technology approved the National Science and Technology Program “Searching for and transferring foreign technology up to 2030” for the period up to 2030 (Decision No. 168/QD-TTg dated February 17, 2023). The

implementation of the Program aims to achieve the following objectives: Improve the efficiency of technology transfer, mastery, and development from abroad to Vietnam, especially technology in priority sectors and fields to serve the needs of developing new technology products and services, contributing to improving productivity, quality, added value, and competitiveness of products and goods in the market; Forming an international technology partnership network to meet the needs of technology transfer; Improve the quality of human resources for enterprises and science and technology organizations; Establish a database on domestic technology demand, foreign technology supply/technology experts, international technology partners, and support services for searching, transferring, mastering, and developing foreign technology; effectively implement technology transfer support activities, support the improvement of technology decoding capacity for enterprises and science and technology organizations; Promote connection, linkage, and cooperation between domestic localities and foreign localities through technology transfer, mastery, and development activities to create competitive advantages for the localities, regions, and the country.

3.5. Remuneration and use of human resources in science and technology

In 2014, the Government issued a Decree on the use of human resources and talents in science and technology activities (Decree No. 40/2014/ND-CP). The issuance of the Decree aims to create favorable conditions and working environment for individuals in science and technology activities to maximize their capacity and to deservedly enjoy benefits commensurate with the results of science and technology activities; Ensure the right subjects, create conditions for talented people to perform important science and technology tasks to promote their talents and deservedly enjoy benefits commensurate with the tasks they undertake; The State ensures resources to implement policies on the use and remuneration of individuals taking the activities in science and technology.

According to the contents of this policy, Vietnam will create favorable conditions in terms of working conditions, training, fostering, research funding, remuneration, rewards, etc. for individuals participating in S&T activities depending on their capacity, qualifications, and ability to contribute to the development of national S&T.

3.6. Some existing problems in Vietnam's S&T policy

Vietnam's S&T policy in the recent period has had many positive impacts on the development of S&T, and the country's socio-economic development in general. However, this policy still has some problems that need to be considered:

Firstly, compared to policies in other fields, the S&T policy is not very effective and efficient due to conflicts with other sectoral policies or the incomplete legal corridor.

Secondly, the investment resources from the State budget for S&T activities are still very modest compared to the international average levels and are also scattered, spread out, and unconcentrated on key fields and projects. The financial mechanism

for the implementation of the State's S&T tasks is still heavily administratively bureaucratic, which is not suitable for the characteristics of creative activities. On the other hand, there is a lack of effective mechanisms and policies to mobilize non-state budget capital sources for science and technology. There is a lack of venture capital to encourage research and application of high technology in production and business.

Thirdly, some regulations on mechanisms and policies do not properly reflect the characteristics of science and technology activities, which are inherently uncertain and risky, and not all the R&D products are marketized (especially in the short term). Classifying science and technology activities in the category of "public services, serving state management" does not fully reflect the nature of science and technology activities that are associated with the development of productive forces, and directly becoming productive forces, which are not simply public services, and serving state management.

Fourthly, although there are regulations on the use and treatment of scientific research staff, the implementation of financial mechanisms and regimes for individuals working in science, technology, and innovation, especially those with high qualifications and excellent expertise, still has many shortcomings, not equally commensurate with their creative work and actual contributions (for example Salary and bonus regimes are applied according to the administrative civil servant evaluation system, according to ranks, titles, seniority, etc.; the mechanism for recruiting and appointing scientists is also applied according to the recruitment and appointment regime for civil servants; etc.). In the long term, this will lead to a decline in the scale and quality of scientific research staff due to the inability to recruit and the lack of a suitable treatment regime for creative intellectual workers.

Fifthly, science and technology organizations are at the core of building and developing the national science and technology capacity. The implementation of autonomy for professional career organizations is necessary and in line with the trend of modern government management. However, for S&T organizations, the construction of an autonomous mechanism based only on financial autonomy is not based on the classification according to the nature and importance of the research functions and tasks of the organizations (serving the strategic S&T orientations of the State or serving the common development goals associated with production or public goals, etc.), not taking into account the inherited specific characteristics of scientific research activities and intellectual labor, which will lead to a decline in the quantity and quality of S&T organizations in the long term. At that time, Vietnam will face many difficulties in building and developing national S&T capacity due to the lack of a strong S&T organization.

Sixthly, the business force is the key factor in exploiting and transforming S&T's achievements into products and services to serve social needs and thereby contribute to the socio-economic development of the country. To promote technological capacity in the business sector, the state needs to have science and technology policies focusing on technology development, application, and commercialization

associated with the country's priority and spearhead industries. In this regard, Vietnam does not have a complete and effectively implemented industrial policy system.

4. Some comments and findings

S&T policies play an important role in realizing the socio-economic development goals of many countries in the world. The study on the experiences of Japan, South Korea, and China shows that the S&T policy system has made an important contribution to these countries improving their S&T capacity, creating products and technologies that directly contribute to the successful industrialization process in a short period. In terms of priority orientation, the science, technology, and innovation policies in the industrialization promotion period of the above countries all focus on accessing and exploiting imported technology or creating indigenous technology to quickly improve productivity, quality of goods, and national competitiveness.

For Vietnam, the S&T policy system has taken shape and has made positive contributions to the country's industrialization process. For science and technology policies to contribute more actively to accelerating the country's industrialization process as in the case of the above-mentioned countries' experiences, perhaps in the coming period, the Government needs to consider adjusting and perfecting the science, technology, and innovation policy system in the following direction:

- Remove barriers in the legal system, as well as in economic, financial, and investment policies for science, technology, and innovation activities and for implementation of autonomy policy of science and technology organizations;
- Build unique and outstanding institutions, mechanisms, and policies to promote the application and transfer of technology in the business sector;
- Allow the implementation of a mechanism for testing new policies, and accepting risks in the deployment and application of new technologies, innovation, and new business models;
- Strongly implement the socialization of investment sources for science, technology, and innovation, focusing on and from businesses;
- Closely link social sciences and humanities with natural sciences, engineering, and technology in the process of socio-economic development; clearly define targets and action programs to apply and develop science, technology, and innovation in all aspects of activities at all levels, sectors, and localities./.

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