

NATIONAL ENDOGENOUS SCIENCE AND TECHNOLOGY CAPACITY: CURRENT SITUATION AND SOLUTIONS

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Summary:

The process of industrialization and modernization in Vietnam has been carried out for quite a long time. Only since the country's reunification (1976) until now, the industrialization process has taken place for nearly 50 years. Despite of achieving great and historically significant milestones and robust comprehensive development compared to pre-reform years”, Vietnam has recently transitioned to a lower-middle income country. Vietnam is striving, by 2025, to surpass the lower-middle income threshold, become an upper-middle income country by 2030, and become a developed, high-income country by 2045. To accomplish this goal, the 13th National Party Congress outlined the task of “Continuing to promote industrialization and modernization on the foundation of scientific, technological and innovation progress”. Within the scope of this article, the author presents various aspects of solutions to enhance the nation's endogenous science and technology capacity, contributing to the task of industrialization and modernization advancement, based on the progress of science, technology, and innovation (STI).

Keywords: *Endogenous scientific and technological capacity; Scientific and technological progress and innovation; Promote industrialization and modernization.*

Code: 23091401

1. Concept and role of national endogenous scientific and technological capacity

The Vietnamese dictionary defines: “Capacity: The subjective or natural ability or condition to perform a certain activity”; “Endogenous: Born from within something itself”². From these definitions, it can be determined that “Endogenous capacity is the subjective or natural ability or condition generated from within each subject to perform a certain activity”. Endogenous capacity is considered to be determined in various fields, such as economics, science and technology, national defense and security, social culture...

In the report *The New International Economic Order* (1979), the United Nations introduced a general concept of national technological capacity to promote socio-economic development of the developing countries by creating favorable conditions for enhancing their domestic technological capacity and effectively deploying the existing technologies and responding to technological changes.

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² Institute of Linguistics. *Vietnamese Dictionary*. Da Nang Publishing House, 2000, page 660 and 738.

Accordingly, national endogenous technological capacity represents a country's ability to create, develop and apply domestic technology without relying too much on knowledge and technology from outside. The United Nations believes that national endogenous technological capacity is an important part of building a new international economic order to rebalance economic relations between rich and poor countries. At the same time, it is ensuring the right to self-determination and development of developing countries. However, this is not always and everywhere possible due to the economic, political, and social challenges.

From the general concept of endogenous capacity in the Vietnamese Dictionary and the concept of endogenous technological capacity of the United Nations, it can be determined that, the Endogenous Capacity of Science and Technology is an internal science and technology capacity of a subject capable to master the process of researching, creating, receiving, exploiting, and transferring scientific and technological advances to serve the effective implementation of determined goals. Depending on different points of views, this subject can be an individual, an organization (a business), an economic industry, or a locality and a country. According to each specific subject, there are many types of endogenous S&T capacity, such as the individual's, the organizational (enterprises), the industrial, the local and the national ones. These types of endogenous S&T capabilities are closely related to each other, in which the national endogenous S&T capabilities are not just the sum of the endogenous S&T capabilities of individuals, organizations and industries within the country, but it also serves as the foundation for the individual, organizational and industrial endogenous S&T capacity and the foundation for the national S&T strength. National endogenous S&T capacity includes two closely related aspects, such as: (i) Ability to self-create new S&T products and to innovate, improve, and raise up the S&T level of the existing products; (ii) Ability to select and import foreign S&T products and the to "internalize" those products in accordance with the country's practical conditions. For developing countries, when the domestic S&T level and capacity are still low, along with focusing on the first (i) aspect, special attention should be paid to the second (ii) aspect. It is a reasonable way to implement the combining approach for improving the country's endogenous S&T capacity in one hand and with obtaining and using the advantage of exogenous S&T capacity to promote industrialization and modernization of the country, to narrow the S&T levels gap compared with developed countries.

The content of the national endogenous S&T capacity is expressed through different evaluation criteria. Around the world, to evaluate the innovation capacity and results of economies associated with science and technology development, every year, since 2009, the World Intellectual Property Organization (WIPO) has coordinated with Cornell University (USA) and the INSEAD Business Institute (France) issue the Global Innovation Index (GII). In 2021, WIPO announced the GII with 7 main index groups with 84 specific

indicators. The main index groups include: (1) Institutions; (2) Human capital and research; (3) Infrastructure; (4) Level of market development; (5) Level of development of the enterprise; (6) Knowledge and technology output; (7) Creative output.

In these 7 index groups, the groups (1), (2), (3), (4) and (5) represent innovation input indices. Index groups (6) and (7) represent innovation output indicators. Although Indicators for assessing capacity and innovation results do not directly represent national endogenous S&T capacity but it can be considered an important supporting point to determine the national endogenous S&T capacity assessment criteria for each country.

In Vietnam, on December 15th, 2019, the Ministry of Science and Technology issued Circular No. 17/2019/TT-BKHHCN guiding the assessment of the level of production technology capacity of enterprises. This Circular stipulates 5 groups of criteria with 26 specific criteria used to evaluate the level of production technology capacity of enterprises. They are: (1) Group of criteria to evaluate the status of technological equipment with 7 specific criteria; (2) Group of criteria to evaluate the effectiveness of technology exploitation with 5 specific criteria; (3) Group of criteria to evaluate organizational and management capacity with 5 specific criteria; (4) Group of criteria to evaluate R&D capacity with 5 specific criteria; (5) Group of criteria to evaluate innovation capacity with 4 specific criteria. These criteria are limited to use in assessing technological capacity at the enterprise level and are not for assessing endogenous national S&T capacity.

On May 15th, 2018, the Ministry of Science and Technology issued Circular No. 03/2018/TT-BKHHCN on the List of statistical indicators of the S&T sector. This statistical indicator list includes 10 groups of indicators with 53 specific indicators: (1) Group of indicators for S&T infrastructure with 3 specific indicators; (2) Group of S&T human resource with 2 specific indicators; (3) Group of S&T finance with 2 specific indicators; (4) R&D target group with 5 specific indicators; (5) Group of S&T international cooperation with 5 specific indicators; (6) Group of innovation and technology transfer targets with 12 specific indicators; (7) Group of Intellectual property with 5 specific indicators; (8) Group of S&T publications with 2 specific indicators; (9) Group of standards, measurement and quality indicators with 11 specific indicators; (10) Group of atomic energy, radiation and nuclear safety with 6 specific indicators.

This system of statistical indicators is aiming to serves the state S&T management on a national scale, so it also includes indicators with administrative content (For example, indicators Number of entering-the-country foreign delegations, or Number of going abroad delegations concerning S&T activities in the 5th group of indicators) or focusing on a very specific field (For example, indicators in the 10th group of indicators). Of course, these indicators are not reflecting the country's endogenous S&T capacity.

Based on the mentioned above connotation of the concept of national endogenous S&T capacity, referring to the regulations of the World Intellectual Property Organization and the regulations of the Ministry of Science and Technology, the content of the national endogenous S&T capacity can be determined and includes groups of specific criteria as following:

(1) Group of criteria reflecting the S&T human resources capacity (quantity, quality, structure) to perform the task of developing and applying STI advances (Ratio of technical workers in the total number of employees; Quantity, quality, structure of research staff; Quantity, quality, structure of intellectuals; Number of leading intellectuals in the field...).

(2) Group of criteria reflecting the infrastructure capacity to ensure STI development (material and technical facilities of science and technology organizations; measurement and standards system, key laboratories; high-tech areas, high-tech agricultural zones, technology incubation facilities, science, and technology business incubation facilities; IT infrastructure; S&T information infrastructure; science and technology market...).

(3) Group of criteria reflecting the financial resources capacity to ensure the development and application of STI advances (Level and ratio of state budget expenditures; state budget expenditures allocation to Key S&T fields; businesses and the whole economy investment level for R&D activities; Level and rate of outside-the-state-budget mobilization of capital sources for STI development...).

(4) Group of criteria reflecting the technology level and technology capacity to exploit and use of existing technology (Ratio of modern technological equipment in total technological equipment; Level of technological equipment compared to the world average level; technology level equipped for 1 worker; capacity usage Level of technological equipment; Level of energy waste per unit of GDP; IT and digital technology and digital transformation application level; new and improved products, and existing technological processes or technological equipment improvement...).

(5) Group of criteria reflecting the capacity to organize and manage the development of STI (capacity to plan and organize and implement the STI strategies; quality of SIT policy and institutions; Quality of identification and implementation of key national S&T programs; Evaluation capacity of imported technologies; Quality and effectiveness of S&T international cooperation; Identification and application of evaluation criteria for effectiveness of STI investment; linkages and cooperation Organizational ability between subjects in STI...).

(6) Group of criteria reflecting the STI development results (Quantity and quality of domestic and international research publications; Number of registered intellectual property rights; Number of patents; Contribution of S&T

to growth; high-tech product value in total product value; Labor productivity level and social labor productivity growth rate...).

National endogenous S&T capacity is the factor, determining the speed and quality of the country industrialization and modernization process. Because the core content of the industrialization and modernization process is the process of technical facilities building, production forces development through equipping and re-equipping modern technology for all enterprises in all fields of socio-economic life to effectively exploit the country's comparative advantages, increasing labor productivity, and improving the material and spiritual life of the people. Although a country in its industrialization and modernization process can take S&T advantageous support from developed countries, but such outside support cannot replace the country own efforts itself. Furthermore, external outside support can only be effective if the technology transfer receiving country knows how to choose science and technology products suitable to the actual conditions of its country. From there, the national endogenous S&T capacity contributes to ensuring the country's stable and sustainable long-term development and ensuring the country's political and economic independence and autonomy.

With such a huge role, improving the nation's endogenous S&T capacity is the most important condition for the STI advancement to truly become the foundation for implementing the task of promoting industrialization and modernization in the context of today's STI development scene.

2. Status of Vietnam's endogenous science and technology capacity

In Vietnam, in Party Congress documents S&T are always placed at an important position. Third Party Congress Documents (1960) determined that “The S&T revolution plays a key role”. The VII mid-term conference Documents (1994) determined the viewpoint that “science - technology is the foundation of industrialization and modernization”. In the VII (1996), IX (2001), X (2006), XI (2011), XII (2016) and XIII (2021) Party Congresses documents, this viewpoint continues consistently affirmed, and at the same time, further emphasized its role as “the leading national policy, the most important driving force to promote industrialization and modernization and is a content that needs to be prioritized for investment one step before all”.

In recent years, the implementation of the Party's viewpoints and policies on promoting the role of science and technology in the country's industrialization and modernization has achieved positive results. The country's S&T potential has been enhanced. S&T has made positive contributions to the country's socio-economic development achievements... However, S&T is not really becoming “the leading national policy, the foundation and driving force for promoting industrialization and modernization”. Our country's national endogenous S&T capacity is still low.

Below are some typical examples:

- *Human resources do not meet the requirements of developing and applying advances in science, technology, and innovation.* Abundant in quantity human resources and workers capable of quickly absorbing technology are one of Vietnam's potential advantages. However, the low in quality human resources is one of the bottlenecks hindering the implementation of the task of promoting industrialization and modernization of the country. The trained workforce with certificates and degrees, although increasing rapidly, is still low compared to requirements (only accounting for about 25% of the total workforce in society). The consequence of this situation is that Vietnam's labor productivity is still low compared to other countries in the region: In 2020, according to actual Gross Domestic Product (GDP), Vietnam's labor productivity 8.8 times lower than that of Singapore, 3 times lower than that of Malaysia; If calculating GDP according to Purchasing Power Parity (PPP), Vietnam's labor productivity is only equal to 8.99% of Singapore, 23.21% of Malaysia, 40.31% of Thailand (Tung Nguyen, 2023). According to the International Labor Organization (ILO), in 2021, Singapore's labor contributes to GDP 73.7 USD/hour of labor, while that of Vietnam is only about 7.3 USD/hour.

Although the number of Vietnamese intellectuals has increased, its structure is not reasonable and is concentrated only in a certain number of industries, professional occupations, and localities. Some people with advanced degrees have not demonstrated adequate practical capacity in STI activities. There is a lack of leading intellectuals, especially in the key sciences of the Fourth Industrial Revolution. On average, Vietnam only has about 7.4 researchers per 10,000 people. This ratio for Singapore is 69.2, for Malaysia is 23.6 and for Thailand is 12.1 (*Ministry of Science and Technology, 2020*).

- *Inadequacies in infrastructure* for STI development. By 2023, the country will have over 1,600 S&T organizations of all economic sectors, and about 2,000 S&T enterprises. The system of high-tech zones, high-tech agricultural zones, centralized software zones, and national key laboratories are of interest for investment and development. However, S&T infrastructure is still underdeveloped, and does not meet the country's development requirements. The system of research laboratories and equipment cannot keep up with the rapid development of S&T. There are no world-class research facilities, laboratories, or research universities. Close linkages and coordination between S&T organizations and businesses have not been established.
- *Limitations and inadequacies in ensuring and managing financial resources* for STI development. Although the level of state budget spending on science and technology has continuously increased over the years and in 2022 will reach a rate of over 0.8% of total state budget expenditures, this rate is much lower than the regulations (Minimum rate is 2% of state budget expenditure) and is far lower than the requirement. Overall, both state budget and private

investment in S&T in Vietnam are only at a rate equivalent to 0.5% of GDP; Compared to the world average rate of 2.23%, Vietnam's rate is only about 44.6% (*Nhi Anh, 2022*). While ensuring financial resources for science and technology development is still limited and the use of these resources does not ensure the desired effectiveness, financial policies for science and technology development also have many shortcomings: There is no consistency in policies and laws on investment, public investment, public procurement, public assets, and taxes; S&T investment resources mainly come from the state budget, outside-the-state-budget financial sources have not been fully exploited...

- Limitations and inadequacies in *the existing level of technological equipment*. Although the technological equipment level of economic sectors has improved in recent years, Vietnam's technological equipment level is still lower than the world average level. In industry alone, most businesses currently still use technology that is about 2-3 generations lower than the world average, of which over 75% of equipment imported from abroad is of generation in the 1970s. Despite of low level of technological equipment, businesses have not paid enough attention to investing in technological innovation. The investment rate in technology innovation of Vietnamese enterprises is only less than 0.5% of revenue (while in India it is 5%, in Korea it is 10%)³...

Although the S&T contribution to growth has increased, it is still low compared to other countries in the region. Contribution of total factor productivity (TFP) to growth increased from 33.6% in the period 2011-2015 to 45.2% in the period 2016-2020, for the 10 years 2011-2020 overall reaching 39.0%. Meanwhile, Korea's TFP is 51.5%, China's 52%, Thailand's 53%... (*Lan Huong, 2021*).

- Limitations and inadequacies in *S&T management capacity*. Although there have been many efforts to reform to promote the role of S&T in the country's socio-economic development, the current management capacity and management mechanism of S&T are not truly appropriate with the market mechanism, with the intrinsic S&T characteristics and in the globalization and international economic integration trend. The goals and strategic orientations of science and technology development still contain subjective elements and are not really close to the requirements and conditions of industrialization and modernization. The S&T management mechanism is still heavily administrative, not suitable for the characteristics of creative labor and the market economic mechanism. Financial management mechanisms and policies in S&T activities have not created motivation and favorable conditions for organizations and individuals to promote the creative capacity of S&T organizations and teams.

³ Central Economic Commission: Project on the orientation, policies of socio-economic development until 2030, with a vision to 2045.

From some above mentioned typical basic features, it can be clearly seen that our country's national endogenous S&T capacity is still low compared to the world class level and compared to the country requirements of promoting industrialization and modernization. This is one of the big challenges for our country in the context of increasingly deep international integration while the Fourth Industrial Revolution has a strong and direct impact on all aspects of country's socio-economic life.

3. Some solutions to improve endogenous technological capacity to contribute to promoting the country's industrialization and modernization

Based on the analyzing the new context and new requirements for industrialization and modernization, the 13th Party Congress (2021) has determined the task of "Continuing to promote industrialization and modernization on the foundation of STI progress". To effectively carry out this task, a synchronous system of solutions is required, in which improving national endogenous technological capacity is the most important solution.

On May 11, 2022, the Prime Minister signed Decision No. 569/QĐ-TTg promulgating the STI Development Strategy until 2030. This Strategy clearly identifies viewpoints, goals, and task directions and solutions to promote the development of STI to contribute to realizing the task of promoting industrialization and modernization of the country.

In this paper, we would like to highlight some solutions, which help concretize and organize the tasks implementation and improve national S&T capacity.

Solution 1: Strong reform and synchronization of institutions and policies to develop science, technology, and innovation

This solution defines the role and responsibility of the State in promoting the STI development and to carry out the task of promoting industrialization and modernization of the country. Based on the scientifically prepared science and technology development strategy, the State needs to create a favorable, open, and stable institutional environment for STI research activities. The institutional and policy reform to promote the STI development must pay special attention to the intrinsic and specific characteristics of scientific research activities, in consistency with market principles and international practices, and accept the risks and delays principle in science, technology and innovation research activities.

Among the contents of the STI institutional reform and development policy, we would like to highlight the following points:

- Build a mechanism to promote technological innovation towards the application of new and modern technology; Support importing core technology, high technology, designs purchasing, foreign and domestic experts hiring in priority fields, business's technology purchasing from

domestic research institutes and universities. The State proactively purchases S&T results in case of need. Effectively stop and prevent the import of outdated technology and technology that is harmful to human health, natural resources, environment, socio-economic, national defense and security.

Implement a special investment mechanism to deploy a number of large-scale S&T projects that serve national defense and security or that have a strong impact on the productivity, quality and competitiveness of national products;

- Review and make amendments and supplements to the legal system on S&T and related laws to overcome the overlaps, duplications and conflicts, especially regulations on investment and public investment, public procurement, state budget management, public asset management... Perfecting laws on intellectual property, protecting and effectively and reasonably exploiting intellectual assets created by Vietnam;
- Comprehensively reform scientific research management activities at all levels and sectors; Widely apply IT in scientific management; Firmly eliminate complicated administrative procedures that are troublesome and lead to unnecessary time waste, ensuring that scientists can focus highly on creative research activities;
- Implement the autonomy and self-responsibility mechanism of public S&T organizations in terms of human resources management and operating costs based on results and operational efficiency. Strengthen linkages between S&T organizations and businesses in performing applied research tasks, technological innovation, and human resource training. Pilot the public-private partnership and co-sponsoring mechanism in the S&T tasks implementation. Assign ownership of the scientific research and technological development results using state budget to the agency who are in charge of S&T tasks, and at the same time, have a reasonable benefits division mechanism between the State and host agencies and authors. Create favorable conditions for S&T organizations to lend the money from S&T funds or credit institutions.

Solution 2: Increase investment and improve investment efficiency for science, technology, and innovation development activities

Securing financial investment is one of the essential conditions for STI research activities. Besides of the state budget increasing and ensuring effective use of this investment, there needs to be appropriate mechanisms and policies to mobilize other financial investment from private sector and society to invest in STI.

- Strictly implement the regulation “Spending on STI not less than 2% of the total annual state budget expenditure and gradually increasing according to the development requirements of the S&T cause”. Reform the mechanism for

developing S&T plans and budget allocations for S&T activities in accordance with the S&T intrinsic characteristics and the developmental needs of the country, and industrial sectors and localities; Ensure synchronization and cohesion between long-term development orientation, and medium-term development program and annual science and technology research and application plan. At the same time, along with ensuring financial resources spending and investment from the state budget, special attention should be paid to ensuring the effectiveness of science, technology and innovation investment using. Widely implement the project based procurement form based on final products spending, and at the same time, apply an appropriate form of the investment's monitoring;

- Promulgate appropriate mechanisms and policies to widely mobilize resources outside the state budget for the development of STI research activities. Based on the awareness that businesses are the place where demand arises, where the achievements of STI advances are directly applied, it is necessary to review and remove existing and potential barriers to increase the number and the scale of the enterprise's science, technology and innovation development fund; Create maximum favorable conditions to encourage businesses to establish funds and effectively use funds for STI activities;
- Encourage private sector individually to establish or in cooperation with the State to establish venture funds for new and high technology research and development activities. Research and promulgate regulations on domestic enterprises establishing S&T development funds, considering this a mandatory requirement for state-owned enterprises and an encouraged activity for other enterprises.

Solution 3: Improve the quality of human resources, promote the role of intellectuals to meet the requirements of science, technology, and innovation development

High-quality human resources, including intellectuals, are the foundational element of the nation's endogenous S&T capacity. Therefore, to improve the nation's endogenous S&T capacity, it is necessary to place the development of S&T human resources with high quality, qualifications and creative capacity as a key task. In this solution, we would like to highlight the following key points:

- Promote the implementation of the 8th Conference of the Party Central Committee term XI (November 2013) resolution, on fundamental and comprehensive education and training reform to meet the needs of industrialization and modernization in the economic conditions with socialist-oriented market economy and international integration. It can be affirmed that the quality and effectiveness of implementing this task have a direct impact on improving the nation's endogenous scientific capacity and on the results of promoting industrialization and modernization based on STI

progress. Focus on developing a high-quality vocational education institutions network in key industries and professional occupations. Form high-quality schools, national and regional centers for high-quality vocational training and practicing that serve as nuclear in nature, in leading, spreading, and implementing effective regional linkages to meet the needs of highly skilled human resources from key and spearhead industries and fields. Develop high-quality training programs associated with new occupations, and new technology application, and with high tech, new and future skills. Encourage and facilitate the development of joint training programs with foreign entities and high vocational training programs for foreigners living in Vietnam. Develop training activities in accordance with advanced training programs of developed countries.

Diversify and fundamentally reform the methods of organizing training according to the comprehensively capacity and qualities development of young people approach; unleash potential, and arouse positivity, initiative, creativity and the ability to apply knowledge and skills of young people into professional practice; reform the evaluation and certification methods of graduation with the participation of businesses for high quality programs...

- Plan the S&T human resource development closely links with socio-economic development planning, meeting the requirements of promoting industrialization, modernization, and international integration. Develop and implement policies on training, fostering, using, rewarding, and honoring S&T staff, especially the excellent and having many contributions experts. Create a favorable environment and material conditions for S&T staff to work with their talents and to enjoy benefits in accordance with their creative labor value. Improve the capacity, qualifications and qualities of S&T managers in all levels and sectors.

Build a policy to support domestic S&T staff to work and to intern at S&T organizations and businesses abroad to solve S&T tasks of national importance. Protect the legitimate rights and interests of authors of S&T works; Building a policy to remunerate and reward the authors having international publications and protected domestically and internationally patents.

- Promote the role of the intellectual workforce in carrying out the task of promoting industrialization and modernization based on the foundation of STI progress. In all times, the intellectual workforce has always been the basis of social progress, the core force carrying out the mission of creating and spreading knowledge, creating the country's strength. Create an environment for STI activities and promote the role of intellectuals. Implement democratic regulations in S&T activities, ensuring academic freedom for intellectuals at educational entities and research institutes. Strengthen the enforcement of intellectual property rights and industrial

design rights to ensure the benefits of intellectuals and entrepreneurs when transferring inventions and encourage intellectuals to increase their dedication.

It is necessary to do research and promulgate policies to create a favorable environment and conditions for intellectuals to promote their ability to create modern S&T achievements to meet the country's development requirements.

It is necessary to have mechanisms and policies to build a leading scientists workforce, capable of creating, orienting and leading research teams to create modern S&T products that match with the main development trends of the epoch and meet the practical country's development needs.

Building a policy of special respect and incentives for leading S&T workforce, and leading and talented young scientists and technologists assigned to preside over important national tasks.

Doing the research to amend, supplement and improve policies to attract and remunerate Vietnamese originated intellectuals abroad with high professional qualifications, and management and execution capacity, and the ability to transferring engineering technics and technology to Vietnam. Having the mechanisms and policies to encourage domestic S&T entities to cooperate, exchange experts, and attract oversea Vietnamese intellectuals abroad to work in Vietnam. Create favorable conditions for overseas Vietnamese intellectuals to live and work in Vietnam. Strengthen praising and rewarding Vietnamese organizations and oversea outstanding individuals to promote the campaigns of community building and to contribute to motherland's reconstruction.

Solution 4: Develop synchronous S&T infrastructure and to create modern physical facilities to promote scientific, technological and innovation progress

S&T infrastructure holds a key position in the country's socio-economic infrastructure system. Along with a high-quality S&T human resources workforce, synchronous and modern development of S&T infrastructure is the most important condition to improve the country's endogenous S&T capacity. Therefore, developing synchronous and modern S&T infrastructure should be considered one of the priority tasks in developing the country's socio-economic infrastructure system. The government has a leading role in implementing this task. That role is expressed in the following main aspects:

- Along with increasing the level of state budget investment for the STI development, in allocating financial resources, it is necessary to give adequate priority to the task of investing in developing S&T infrastructure. In the context of limited financial resources, these financial resources need to focus on additional investment, upgrading and modernization of S&T infrastructure for research institutes and universities assigned to implement the national target programs to develop high technology, spearhead

technology, develop national products, and national technology innovation programs;

- Along with completing and supplementing relevant legal regulations, it is necessary to focus on increasing investment in high-tech parks in Hanoi, Ho Chi Minh City and Da Nang, ensuring these high tech parks effectively perform its assigned functions (Implementing high tech research, and development and application activities; Incubating high techs and high-tech businesses; Producing high tech products, providing high tech services; Focal point for linking entities in the new technology development and application...). Directing the concentrated development of high-tech agricultural zones in key agricultural areas, promoting their role in modern and sustainable agricultural development;
- Research and promulgate mechanisms and policies to encourage and create favorable conditions for non-state economic sectors, including foreign investors, to invest in developing S&T infrastructure. This will be done through investing in equipment for enterprise's research and development (R&D) activities or establishing excellent research units in private business groups and foreign direct investment businesses, medium and large-scale, operating in key technology fields. Mobilizing the non-state budget resources to invest in developing S&T infrastructure should be considered a strategic task. This infrastructure not only directly meets the STI development needs of businesses in these economic sectors, but also contributes to strengthening the nation's science and technology infrastructure and improving National endogenous S&T capacity;
- Within the framework of implementing a strategic breakthrough in building a synchronous and modern infrastructure system both economically and socially, it is necessary to focus on developing ITC infrastructure, creating a Platform for national digital transformation, and gradually developing digital economy and digital society. To ensure financial resources for the construction of ICT infrastructure, in addition to prioritizing investment from the state budget and increasing investment from state-owned economic groups (Groups of Military Telecommunications - Viettel; Vietnam Posts and Telecommunications Group - VNPT;...), the Government needs to have a mechanism to encourage and create favorable conditions to mobilize investment resources from the domestic non-state economic sector and foreign direct investment economic sectors. In investing in the development of ICT infrastructure, it is necessary to focus on selecting modern technology, making breakthroughs in the infrastructure level, creating a solid foundation for STI development activities, narrowing the technological level gap of this key economic sector compared to the level of developed countries;
- Focus on building and improving information infrastructure, national S&T database, and S&T statistics. This creates favorable conditions for S&T

management agencies, and businesses and organizations, as well as researchers to access the S&T information, to find necessary information, and to avoid overlap and duplication in implementing creative research and development activities, promoting exchange relationships between S&T supply and demand sides. Building and completing the national database on S&T is the responsibility of state management agencies on S&T at all levels, among which the National Agency for Science and Technology Information (NASATI) under the Ministry of Science and Technology plays a central role. With assigned functions, NASATI is responsible for organizing and implementing information and statistical activities on science, technology, and innovation, building, and exploiting the national database on S&T, and organizing the National Science and Technology Library activities. This agency must also be the focal point to connect and synthesize S&T information systems from central and local government departments, and research institutes, universities, etc. to form a national science and technology database. At the same time, this agency is also the focal point for implementing international cooperation on S&T databases, collecting, and synthesizing international S&T databases, providing this data to domestic subjects if needed. To carry out this task, on one hand, it requires strengthening staff capacity, investing in facilities, and expanding the application of information technology for agencies in charge of science and technology databases at all levels; on other hand, there needs a clear mechanism for establishing a close and effective coordination relationship between these agencies.

Solution 5: Develop linkages and cooperation between subject entities in science, technology, and innovation development activities

Developing STI is an extremely complex task, often beyond the capabilities of each individual subject entity. Establishing and developing linkages and cooperation between subject entities allows to effectively solve this task. This also positively contributes to improving the country's endogenous S&T capacity.

The content of linkages and cooperation between subjects in STI development activities may include: Linkage and cooperation to create new scientific knowledge; Linkage and cooperation to improve and modernize existing technology; Linkage and cooperation to create new products and new technologies; Linkage and cooperation in technology transfer and applying S&T advances into practice; Linkage and cooperation in human resource training and improving the quality of human resources;...

Depending on the content and scope of STI development activities, the subject entities participating in linkage and cooperation may include: Government (State management agency); Manufacturing enterprises; Credit and financial institutions; Scientific Research Institute; University; Individual or group of scientists; Foreign businesses and organizations. Following the trend of

strengthening international integration, international linkages, and cooperation in the fields of STI are increasingly expanding.

To establish and strengthen linkages and cooperation between subject entities in the fields of STI, many different issues need to be resolved, mainly:

- Unified awareness of the necessity and inevitability of developing linkages and cooperation in STI development. Each subject entity proactively determines its needs and ability to connect and cooperate;
- Comply with the principles of voluntariness, responsibility sharing, benefits and risks sharing in carrying out the science, technology, and innovation development tasks. This principle must be expressed in linkages and cooperation contracts between subjects;
- Diversify the contents and forms of linkages and cooperation to develop STI in accordance with the needs and abilities of each subject...

With the goal of mobilizing the participation of the private sector in solving long-term and mid-term STI issues of key and core strategic nature at the sectoral, regional, or national scales, it is necessary to do research to apply public-private partnership (PPP) form in the ST& field.

4. Conclusion

Promoting industrialization and modernization based on the STI advancements is an urgent task to realize the goal of turning our country into a developing country with a high middle income by 2030 and a modern developed country by 2045. Improving the nation's endogenous S&T capacity is the most important prerequisite condition for the STI advancement to truly become the foundation for promoting industrialization and modernization. Because the core nature of the country's industrialization and modernization process is the process of fundamentally and comprehensively transforming production, business, service, and socio-economic management activities from mainly using manual labor to widely using modern and advanced technology and means and methods. To effectively implement this process, it requires being based on the foundation of STI.

In this article, the author has presented some basic theoretical insights in the national endogenous S&T capacity, and an overall assessment of the limitations and inadequacies of our country's national endogenous S&T capacity. From that point of view, the author presents his initial opinions on several solutions to concretize the guidelines and policies of the Party and Government to improve national S&T capacity to contribute to the implementation of the task of promoting industrialization and modernization based on the science, technology, and innovation foundation./.

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