STUDIES OF STRATEGIES AND MANAGEMENT

SOME THEORETICAL AND PRACTICAL ARGUMENTS ON THE SCIENCE, TECHNOLOGY AND INNOVATION SYSTEM OF VIETNAM IN TREND OF INTERNATIONAL INTEGRATION OF SCIENCE AND TECHNOLOGY

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Abstract:

In this present age, every sector, every country is strongly influenced by science and technology (S&T). S&T has profound impact on the world economy, position location in international relations and all social activities. In their development strategy, countries consider S&T as a means, an objective for socio-economic development, and to consolidate their position in the competitive economic and political struggle. In the context of international integration of S&T, the role of science, technology and innovation system is increasingly emphasized. We do recognize that to build a such successful system, only the task of state management through promulgation of policy mechanisms is not enough. It requires large participation of all components in the system and, above all, high spirit of innovation. Based on theoretical analysis and experience in developing S&T of some countries in the world and taking into account practical conditions of Viet Nam, the authors present some preliminary assessments on existing drawbacks in the S&T and innovation system of Vietnam and then to propose some policy orientations for the S&T system in the future.

Keywords: S*cience and Technology; Innovation; International integration.*

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Introduction

In recent years, science, technology and innovation (abbreviated as STI) has become a component whose role is especially important in the evaluation of sustainable growth and development of all nations. Every country with distinct characteristics of political system, economy, culture, society, S&T has different orientations in the process of establishing and developing their STI system structure as well as planning and implementation of their own

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STI policy. For Vietnam, the process of international integration, particularly in the field of STI, is still slower than that of some countries in Asia as well as in comparison with the progress of many other countries in the world. A lot of issues in both terms, theory and practice, are posed to study with a view to working out various strategy options to select for the construction and development of the Vietnam STI system under the current and future environment of international integration of S&T.

1. Some theoretical issues about STI system

Getting in practice, we found very difficult to have a clear understanding about different concepts that we daily walk through and exchange, i.e science, technology, research, innovation, innovation system, science technology and innovation system, etc. This pile of theories is not easy to visualize, specify and be consistent like the definition of straight line, circle, flat surface, coordinates, acceleration, friction, etc. Therefore, it is necessary to conduct a study of theoretical basis of STI system if we want to elaborate a national S&T development strategy. The purpose of this section is to debate on how the theoretical concept of STI system have been perceived among scholars and how it should be identified when compared with the development practice.

1.1. Science and technology

The function of science always exists at dual levels, that are to promote the curiosity on the one hand, and increase the demand, on the other, but sometimes these two levels interact with each other in a surprising way. For example, the case of Galileo telescope, which initially was merely a pure science research, however, it was then developed and applied to create different products in many sciences such as oceanography, astronomy, space science, etc.

Depending on the intended use, sciences have multiple approaches. The concept of science was defined according to various approaches, as follows *(Vu Cao Dam, 2007, p.59):*

- *Science is a system of knowledge*: it means a system of knowledge about the laws and motion of matters, the laws of nature, society, thinking. Knowledge system here is understood as a system of scientific knowledge, seen as an intellectual product accumulated through innovative activities by using study methods of researcher to discover the nature of the matter, the phenomena;

- *Science is a form of social consciousness*: Under this approach, science is a social spiritual aspect carrying objects and forms. It reflects the social function distinctive to other forms of social consciousness;
- *Science is a social institution*: As a social institution, science penetrates in all spheres of social activity and performs the function of a social institution. Science is regarded as the benchmark in all activities and all fields;
- *Science is a social activity*: it means science has become a professional career with its own characteristics such as explorative, creative, as well as risk taking.

We can consider some other definitions:

In "*MacMillan English Dictionary for Advanced Learners",* it defined: "*Science is the research and knowledge of a physical world and its behavior based on proven experiments and facts and organized into a system"*.

In the presentation on "*Technology can be a tool for development*" [9], Farook A Azam gave an interesting example of technology. He argued that for most people, a simple way to understand technology was anything related to computer and Internet, so how about vitamins? If thinking technology is something created by humans to use to change the way of life and surroundings, then vitamin is technology. And everyone says simply that technology must be related to machinery/equipment or infrastructure under the form of machines such as a radio, telephones or bike. But in essence, it is difficult to recognize the whole structure of technology, such as the radio antenna or the telephone wires and we can see more other technologies if we go further. So to what extent technology could be considered? In the book "*50 ways to leap frog to achievement*," Carolyn J. Downe had considered technology under various angles *(Farook A Azam, 2009, p.112):*

(1) Technology is a subject: tools, machinery and equipment - the physical devices for technical implementation;

(2) Technology is knowledge: the know-how behind technological innovation;

(3) Technology is an activity: the way people do, including the skills, methods, processes and procedures of their work;

(4) Technology is a process: starting with the need and ending with a solution;

(5) Technology is a socio-technical system: the production and use of objects related to the interaction of people and other objects.

In Vietnam S&T Law 2013, it defined: "*Technology is the solution, processes, technical know-how with or without tools and means used to convert resources into products" (Law on S&T, 2013).*

By considering S&T as a subject of study, "*Technology can be understood as any type of knowledge, information, know-how, methodology (called software) stored under different forms (humans, notes and all kinds of equipment, devices, production tools (called hardware) and a number of other potentials (institutions, legislation, services) applied in the real environment to create all kinds of products and services" (Trinh Ngoc Thach, 2009).*

Thus, the general concept of technology is summarized as follows:

Technology is a system of solutions created by the application of scientific knowledge, it is used to solve one or several practical tasks in production, business in the form of technical know-how, reflection, technological process, documents,... and technical advisory services.

Technology consists of hardware and software:

- Hardware: machinery, equipment, tools, building structures, premises.
- Software:
  - + *People:* healthy manpower, production skills, experience, work with responsibility and high performance;
  - + *Information:* data, proposals, projects, descriptions of inventions, technical instructions, production management;
  - + *Organization:* relationship, staff training and location for distribution of resources, networking, planning, executing, and monitoring;
  - + *Consumption:* market demand.

When talking about technology, people often think technology is only related to "hardware". If so understood the meaning of technology is too limited referred only to products from scientific and technological research, highly applied research. But in scientific research, in addition to applied research, we also have basic research. Basic research, by nature, is the basis for other studies, the foundation for applied research and development.

1.2. Research and innovation

Research and innovation are two different processes, in which research is the process of creating new knowledge in 2 forms: basic research and applied research. Research is the process of exploration, discovery of rules or nature of things, phenomena. This process may stem from the need of science itself or from a certain intended purpose.

When reviewing research projects we can see a lot of different definitions of innovation, but to give a comprehensive definition of innovation, it should take the market factor into account, considering innovation as a process starting from knowledge to research to create a new product or make changes to product/services to introduce onto the market.

Another quite interesting and frank definition of innovation when saying: Innovation is the dialogue between knowledge and ideas to reach benefits, it can be used for commercial purposes or to create goods, this benefit may be a new or improved product/process/service. Knowledge gained from research or observations will then be the input of the innovation process.

In the book "*Innovation nation: How America is losing its innovation edge, Why it matters, and What we can do to get it back"* John Kao gave a definition of innovation: "it is the ability of individuals, companies and the entire country in creating a future as a continuous dream. Innovation depends on the volume of knowledge gathered from different scientific disciplines like S&T, social sciences and arts. And it is illustrated by the products, services, experience and process of creative nature. The task of entrepreneurs, scientists and software programmers is of the same way in doing innovation. It is also the role of intermediaries/brokers to recognize the value of innovation ideas and transform them into new business models, recognize new opportunities and make innovation apply in society. It is also a new way to implement and seen it as breakthrough ideas" *(Dirk Meissner, 2010)*.

Based on the two above definitions, we can see that innovation and research are two processes, the first one is the production of knowledge, the second one is to use that knowledge to apply in the market through provision of goods and services. In research, laboratory is the heart of the process, while in innovation the center role is the business (both public and private enterprises). These are two different points to consider when analyzing, planning STI policy and STI system.

2. Practical issues of STI system of Vietnam in the context of international integration of S&T

2.1. Actual STI system of some countries in the context of international integration on S&T

STI is considered as a central factor in promoting achievements and build up the national innovation capacity, a decisive factor of the country competitiveness. According to the annual study by OECD and UNESCO in relation to innovation systems, the investment from the State budget and the financial support system for STI was constantly increasing in countries around the world. In *Sweden:* In 2009, Sweden invested 3.75% of GDP for research and development, higher than the US (2.77%) and Japan (2,44%) [9]. In *Hungary*: The total expenditure on R&D and innovation of Hungary in 2010 reached 299.2 billion Ftl [1], representing about 1.15% of GDP; out of which, the public and private sector accounted for 42% and 46.5%, respectively. The medium term (2007 - 2013) policy strategy of STI of Hungary identified the target of raising the spending on R&D to 1.8% of GDP (currently 1.15%); expenditures from business sector for R&D to 0.9% (currently 0.53%). In *Korea:* In late 2004, the total investment for R&D reached $19 billion, accounting for 2.85% of GDP, and by the end of 2007, Korea's total investment in R&D reached USD 33.6 billion, accounting for 3.47% of GDP *(NASATI, 2010)* showing that the level of investment in R&D has increased rapidly in this country. In 2011, the total investment in S&T of Republic of Korea was about USD 46.5 billion, of which the state invested 13.2 billion (representing 28.3%). The remaining amount of funding came from economic groups, businesses. *Singapore:* Since 2004, spending on R&D was USD 4.062 million, representing 2.25% of total GDP. Private sector spending on R&D accounted for 64% (USD 2,590 million), in total share of R&D expenditure of 1.43% of GDP in 2004. The public sector expenditure was 11%, the higher education sector was 10% and the public research institutes 15% of total spending on R&D. Currently, this figure was almost double and focused on the priority areas that need high investment, It was estimated that spending on S&T of Singapore would reach the figure of 3.5% of national GDP in 2015 as projected by the Government.

In the trend of international integration of S&T, it requires to improve the competitiveness of country based on STI development. To do that, nations have to make many adjustments in their STI system structure and STI policy development. The general trend of countries in the world is to enhance the role and efficiency of government in shaping and macro management of STI through effective policies and investment priorities;

development of diversified financial support policy system for R&D; restructuring and strengthening the role of different elements in the STI system, especially increasing the important role of businesses, the main agent linking elements of the innovation system.

In Russia, in recent years the promotion of innovation has become one of the key tasks in development policy of the Russian Federation towards an innovation economy. Committee for innovation activities coordination under the chairmanship of the President and the Prime Minister was established in parallel with the formation of a network of development organizations (Technology Foundation, Russian venture capital company Russian Development Bank,...); The program promotes innovation at universities; research institutions, innovative activities in state own companies. *Hungary* is a small Central European country with a population of only 10 million people, but basically, Hungary has established a fairly attractive environment for research, development and innovation. With scientific resources of world-class, Hungary ranked 4th out of 13 countries in Europe having the highest indicators of talent and also ranked fourth for quality R&D activities among the countries of Central Europe. However, about innovation index, the country was ranked modest, yet to reach the average level of the EU and stood the last in the listing. The Agency responsible for management of R & D and innovation of Hungary is *National Bureau for Research and Technology* under the Ministry of Economy. This agency performs the function of managing S&T tasks, similar to MOST of Vietnam. The distinct feature is that a number of other activities related to S&T management are delegated to various line ministries, namely: intellectual property managed by the Ministry of Public Administration and Justice; Science Policy and R&D activities in universities managed by the Ministry of National Resources; Space research managed by the Ministry of National Development.

The system of S&T of *Sweden* is characterized by high development of qualified research in both public and private sectors, strong and significantly in international technology cooperation.

In recent years, Sweden has had important changes in the country policy and institutional framework, together with increasing the use of activities *looking forward to technology*, having strategies to develop funds for research through intermediary organizations and measures related to education system.

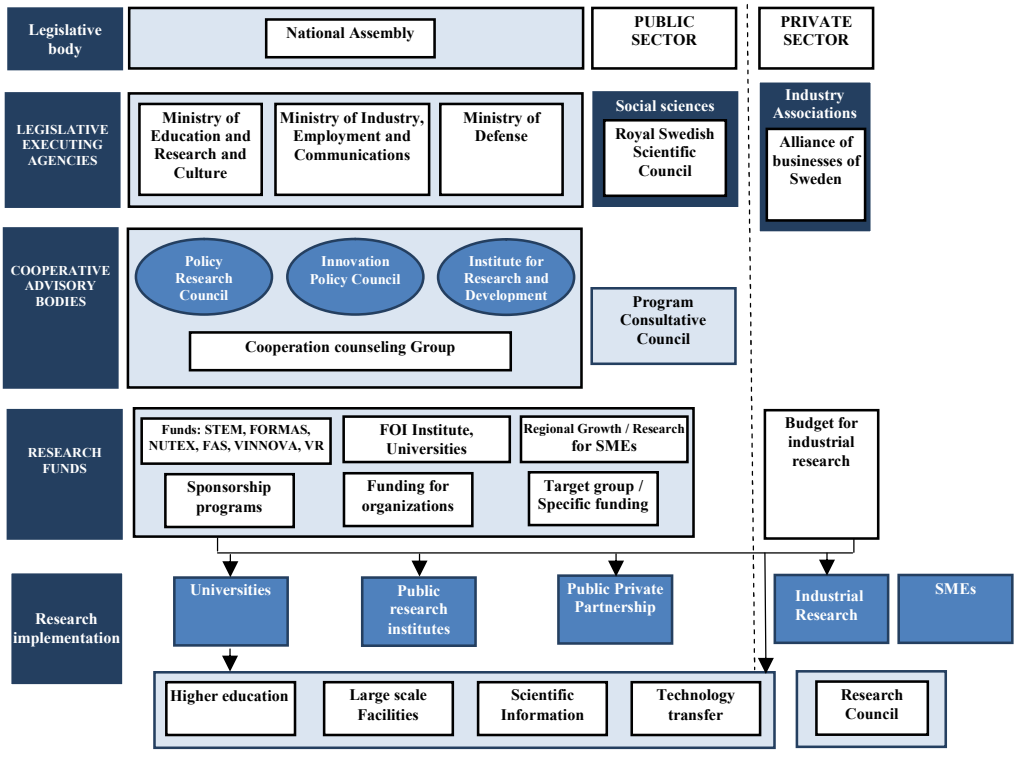

Figure 1: Structure of science and innovation system of Sweden *(John Kao, 2007)*

The STI development policy of Korea is considered as a central factor influencing the progress and achievement of the Korean economy. In the long-term vision, Korean government has launched a long-term strategy called "long-term vision for S&T development up to 2025" outlining the direction for implementation to build an advanced and prosperous economy through the development S&T by creating, using and disseminating knowledge, promoting scientific understanding, and formation of an advanced National S&T management system .

With this vision, Korea has determined a clear development orientation:

- Gradually moving the national innovation system from "Government-led" to "Private-led" system;
- Improving the efficiency of investment in national research and development;
- Making S&T system be in harmony with the global system;

- Responding to challenges and taking advantage of the opportunities brought by new technologies.

Singapore: Singapore's statement reflected the respected views on innovation and strong policies developed for S&T. The Singaporean government has announced a plan to focus on the most valuable asset of the country with statement that knowledge and S&T is the mainstay of the economy of this island nation.

Regarding the organizational structure, the Ministry of Trade and Industry of Singapore is the main agency in charge of issues related to S&T activities. Advisory body and key S&T tasks management of Singapore is the Agency for Science, Technology and Research of Singapore (A * STAR), established in 1991. Funded by the Ministry of Trade and Industry, A * STAR assumes the role of promoting economic development [13]. This new authority includes two research institutes: The Biomedical Research Council (BMRC) and the Science and Engineering Research Council (SERC), each organization consists of 7 institutes. In addition, there are a number of research institutes and universities with outstanding research capacity.

R&D is one of the most important parts of the S&T system in Singapore, to attract investment and the participation of all sectors of the economy including businesses of private sector, universities, government, public research institutions.

In the two years 2011 and 2012, Singapore was ranked 3rd in the listing of global innovation index[2]. STI system of Singapore continued with improvement and innovation. In the latest OECD study on innovation systems of the countries in Southeast Asia, the emerging pattern of institutional framework in S&T policy of Singapore is described as follows *(Carolyn J. Downey et al, 2008)*:

[2] Global Innovation Index developed by the Academy of European Business Administration (INSEAD), and the World Intellectual Property Organization and the Cornell University based on 84 criteria to evaluate innovation process in 142 countries, including the quality of universities.

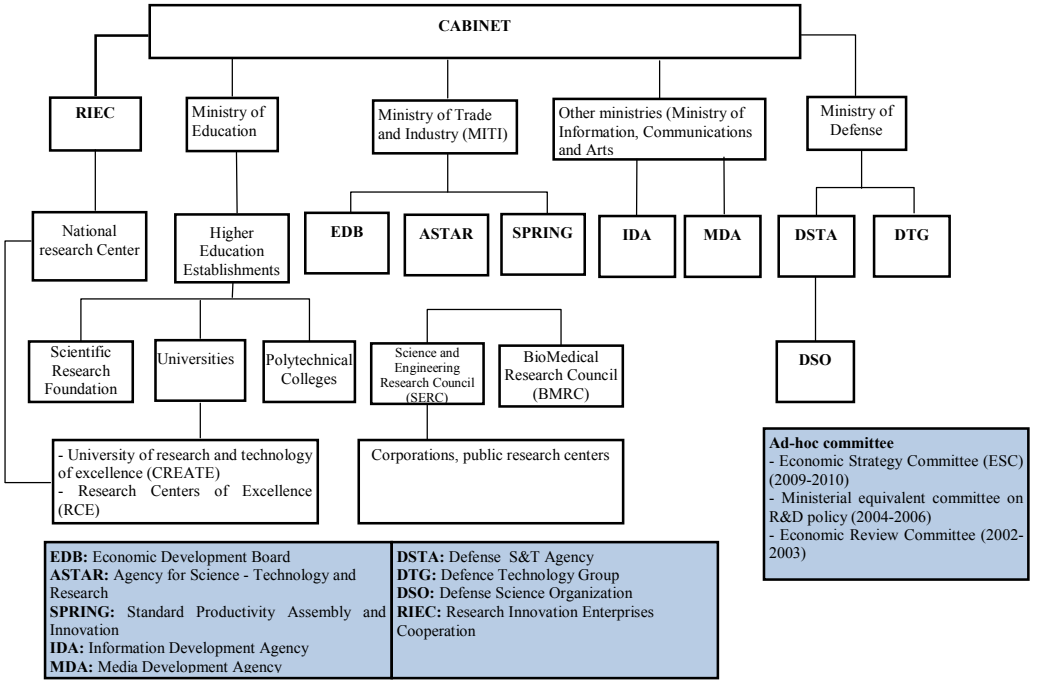

Figure 2. Institutions in the S&T system in Singapore

The study results showed that STI development policies of countries in the world today was beyond the scope of science research and traditional development policy, the development of an appropriate STI policy is not a simple issue and it must be considered under many different aspects, particularly the analysis of the current operation of the national STI system and the link between different elements in the system.

2.2. Current status of STI system in Vietnam in the context of international integration of S&T

In Vietnam, the STI system and STI policy development has gradually been studied and made recommendation in policy making process. Vietnam Government has established a legal framework for the development of scientific and technological activities. Law on S&T was enacted in 2000, it is considered as the backbone of the country's reform. In addition, a number of legal documents ha been issued the operation of S&T, namely (i) the Intellectual Property Law (2005), and then the amended Law to supplement some articles of the Law on Intellectual Property (2009), (ii) the Law on Standardization, Quality control and Measurement, (iii) the Law on Technology Transfer (2006), the Law on High Technology (2008) and the

Law on Atomic Energy (2008) and especially, the Law on S&T (2013). These provisions have laid an important foundation for building up the national innovation system. Recently, the strategy for S&T development 2011-2020 has set specific goals for the future development of the national innovation system in the next 10 years.

In the field of S&T, Ministry of Science and Technology is the state S&T management agency, developing S&T development policy and incentive programs to be submitted to Government for approval, and monitoring the strategic S&T plans. Other relevant ministries such as Ministry of Education and Training (MOET), Ministry of Planning and Investment (MPI), the Ministry of Finance (MOF) also play an important role as stakeholders in the system national innovation system. MPI, MOF are responsible for the construction of mechanisms and policies to encourage promotion of innovation in Vietnam. The National Advisory Council on S&T plays an advisory role. At local level, there are local Departments of S&T being in charge of monitoring STI activities in their regions and localities.

Besides the state management apparatus of S&T, there are other entities involved in supporting innovation and implementation of research and development activities. These are mainly bodies established by the Government such as: National Foundation of S&T Development (NAFOSTED), National Programme on S&T Development for financing basic research, National Agency for the S&T Information (NASATI) and the national program for development of Laboratories/Centres of Excellence. These agencies normally associated with government agencies or ministries.

The indigenous capacity for an STI system being developed and sustainable in the future is reflected in the investment efforts of the Government to catch up the level of development of other advanced countries in the region and in the world. In recent years, Vietnam has made efforts to provide more financial incentives for STI activities. The government has adopted tax incentives for S&T enterprises, on the other side, businesses have invested in technology and equipment innovation. This policy includes value added tax exempted for machinery imported from abroad, tax deduction for expenditure on S&T, tax exemption of corporate venue tax generated from S&T contracts. In addition, there are incentives for all businesses, or business incubator in improving quality of human resources, transfer of technology and technical improvements *(Nguyen Ngoc Anh et al, 2013)*.

However, the new STI policy still follows the traditional way and is heavily of academic feature with a heavy structure and inflexible without using the

new approach. Institution is the legal corridor for the organization and operation of STI but it is still incomplete and unsuitable, without consideration of specific characteristics of STI, especially in situations where countries are fast and vigorously developing as today. In this regard, the design and implementation of an suitable STI policies will have extremely important roles for the development of STI, in particular, as well as for international integration of the national economy development, in general.

The issue of legal corridor provides not much effective impact and support, so it easily observes weaknesses in practical operation of the STI system in Vietnam, namely:

1. *The research sector has not received appropriate investment.* Budgets for R&D activities was around 0.21% of the total national income (GDP) (2011), meanwhile GERD of US in 2011 was 2.77%, 13 times higher than that of Vietnam, China's GERD in 2011 was 1.84%, higher than 8.7 times that that of Vietnam, Korea's GERD in 2010 was 3.74%, GERD of Malaysia in 2011 is 1.07%. If compared the amount for R&D expenditure of the above countries, it must be very much higher than Vietnam's. Research was mainly conducted by fundamental research institutes, which concentrated most in the Vietnam Academy of S&T and the Vietnam Academy of Social Sciences. In universities, besides training as their main function, research was recently touched upon and received attention. However, the research was only concentrated on academic public universities like Hanoi National University, National University of Hochiminh City, Hue University, the University of Danang, etc. On the contrary, private higher education establishments with multiple technical specialized applications had not much R&D activities and R&D investment received. For business sector, R&D has not much received interest and investment. Only some giant enterprises with the specific research and research tradition they can have budget for R&D such as Petro Vietnam, FPT, Viettel Mobile, Viettel Military Telecommunications Group, Global Military Telecommunications Corporation (Gtel), Traphaco Pharmaceutical JSC Rang Dong Vacuum Flask Corporation, etc;
2. *Funding for STI activities primarily relies on the state budget*. Meanwhile, in other countries, this kind of funding was most supported by the business sector. Moreover, these funds mostly were channeled to public organizations without investment to private organizations (private enterprises, private educational establishments or private research institutes). This funding was allocated from the central to local level,

often to the local destination the amount reduced to minimum level to address essential and practical topics. Furthermore, this little funding offer was mixed with admin. budget of the local S&T organization;

3. *S&T tasks were implemented based on contracting arrangement in the form of state order, without initiative proposed by scientists/ businesses.* This leads to two situations, either is passive relying on the order from top government or having emotionless state, not interested with R & D activities;
4. *The research results from R&D were almost incapable of commercializing*. After the completion of State order, the R&D products/ results were returned to the State without concern on their application or end effects. Basic research has a big risk, moreover, the degree of separation between production of scientific results and application of results, in practice, it often needs more support from the State. On the other hand, the State also found difficulty in regulating plan and evaluating the results of basic research;
5. *Businesses do not know much about how to deal with innovation.* It seems that the story of innovation stops only on research papers of scientists. For enterprises, innovation merely is somewhat technological change. Therefore, when conducting study or survey on STI as well as the impact of STI on the development and competitiveness of enterprises, this assessment was not so comprehensive and detailed, businesses found troubled when participating in this kind of evaluation.

3. Recommendations

Through theoretical and practical analysis of the issues of the STI system of Vietnam in the context of international integration of S&T, the author would provide some policy recommendations for STI system development in Viet Nam, as follows:

- S&T organizations must be restructure on the basis of given research directions and they should make their own activity plan;
- S&T organizations should by themselves establish links between research institute - university - enterprises to create correlation between demand and supply in need of manpower, production and research;
- Basic research organizations should be supported by funds from the State. The results of their research will serve for macro-management of the State for economic development. Therefore, the State should make large investment in equipment for these long-term projects. For this kind

of research institutions, the result assessment should be based on basic baseline investigation outcomes;

- It should promote and create markets for STI. As discussed above, it is critical in the STI system to have elements of market. Even for basic research, it can also be developed based on the order from the market or the research itself can identify the market needs to implement. And through the management and development of new commercial products from research results, R&D organizations can generate their income and profits for further investment for R&D. At the same time, in return, through market service provision, organizations can capture the actual needs of the market so that they can make suitable research and development projects./.

REFERENCES

Vietnamese:

1. Science and Technology Law No. 29/2013/QH dated 18/06/2013
2. National Agency of Science and Technology Information (NASATI). (2010) *Korean Strategic Orientations of Science and Technology Development in the first decade of XXI century.*
3. Vu Cao Dam. (2007) *Collection of published works.* Volume I: Theory and Methodology of Science. H .: The Gioi Publishing House.
4. Trinh Ngoc Thach. (2009) *Lectures Series on General Science and Technology*.
5. Nguyen Ngoc Anh, Doan Quang Hung, Nguyen Thi Phuong Mai. (2013) *The Vietnam National Innovation System - A diagnostic review*. TECH MONITOR, April 2013.

English:

6. Carolyn J. Downey et al. (2008) *50 Ways to Close the Achievement Gap.*
7. Dirk Meissner. (2010) *Private sector interaction in decision making processes of public research policy*. Sweden.
8. Farook A Azam. (2009) *Technology can be a tool for development*. http://www.slideshare.net/Farook_A_Azam/technology-as-a-tool-4-development
9. ISA (Invest in Sweden Agency) Automotive: Vehicle innovation the Swedish way. www.isa.se/automotive.AccessedMay2010.
10. John Kao. (2007) *Innovation nation: How America is losing its innovation edge, Why it matters, and What we can do to get it back.*
11. OECD. (2011) *OECD review of innovation in Southeast Asia: country profile of Innovation: Singapore.*
12. MacMillan English Dictionary for Advanced Learners

http://www.macmillandictionary.com/dictionary/british/science

13. http://portal.unesco.org/education/en/files/54654/11939293005Singapore.pdf/Singapore.pdf.