

Vietnamese Enterprises: Current Issues of Technology Transfer

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Abstract—The process of globalization and economic integration nowadays sharply intensifies economic competition in the field of production and services. Technological development is considered as the key to stimulating sustainable economic growth. In Vietnam, statistics show that most enterprises still use medium and backward technologies. Therefore, the products labeled “Made in Vietnam” are hard to compete in global market. In order to make a change, Vietnamese enterprises need to improve technology, including technology transfer, which is the solution to improve quality of the goods production and services, and to improve competitiveness of enterprises in general. In this study, the current consequence of technology transfer of Vietnamese enterprises is reviewed and some recommendations are suggested for further technological development and problem solving.

Keywords—Technological development; Technology transfer; patent; Invention; Utility solution

I. INTRODUCTION

Nowadays, technological progress has a positive impact on economic growth and human society [1]. Krume Nikoloski (2016) in his study of the relationship between technology and economic development concluded that important factors affecting economic growth are natural resources, human capital, capital information, technological development and social-political conditions [2]. Among these factors, technological development plays an essential role in promoting economic growth and creates continuous opportunities for its further progress.

Economic growth has always been connected to technological development, which is proved by the nature of research and development (R&D) efforts that drive productivity growth [3]. This relationship in Vietnam has been also evidenced by the statistics.

The data in Fig. 1 shows the trend of technological development in parallel with GDP growth. By 2015, the invention applications, patents and GDP have increased respectively by 176 per cent, 185 per cent and 336 per cent comparing to those in 2007.

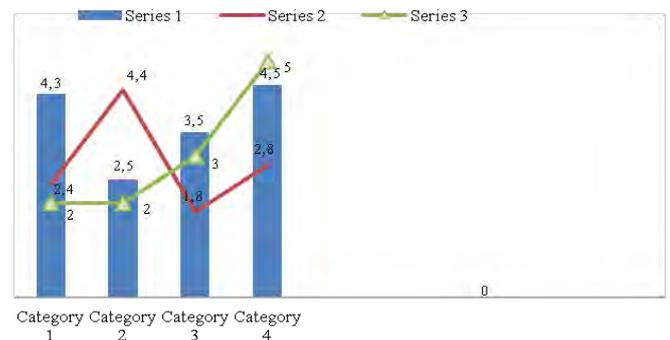


Fig. 1. Economic growth and intellectual property tendency in the period 2007-2015 (GDP in trillion VND). Source: National Office of Intellectual Property of Viet Nam (NOIP), Annual Intellectual Property Report 2015; GDP source from General Statistics Office (GSO), Vietnam.

In Vietnam, technological level is still trivial comparing with other countries in the region. One of the evaluation criteria for technological level is the Environmental Performance Index (EPI). EPI ranks countries' performance on high-priority environmental issue in two areas: protection of human health and protection of ecosystems.

Among the ASEAN' countries Vietnam EPI ranking in 2014, 2016 and 2018 is low in comparison with Singapore, Malaysia, Philippines and Thailand (Table 1). This is the consequence of backward technology that causes the environmental pollution in Vietnam. The other indicator representing technological level is Global Competitiveness Index (GCI). The Global Competitiveness Report 2017-2018 assesses the competitiveness of 137 economies. Even though Vietnam impressively increased 5 ranks from last year and 20 ranks from five years ago, in this period, with the rank of 55th place, it is still lower than other countries in the region such as Indonesia (36th), Thailand (32th) and Malaysia (23th) [4]. Among the subindexes, technological readiness (ranked 79) is one of the indicators that directly assesses the competitiveness of Vietnamese economy and reflects the adaptation of an economy to technologies in order to improve business

performance and emphasize the ability to absorb new technologies.

TABLE I. ENVIRONMENT PERFORMANCE INDEX RANKINGS OF SOME ASIAN COUNTRIES

Country	2014	2016	2018
Japan	26/178 ^a	39/180 ^a	19/180 ^a
South Korea	43	80	60
China	118	109	120
Singapore	4	14	49
Malaysia	51	63	75
Philippines	114	66	82
Thailand	78	91	121
Vietnam	136	131	132
Indonesia	112	107	133
Myanmar	164	153	138
Cambodia	145	146	150
Laos	127	148	153

^a. Total number of ranked countries

Source: *Environmental Performance Index Rankings 2014, 2016, 2018.*

The technological level of Vietnamese enterprises is a matter of concern. According to the results of the 2016 Enterprise Survey conducted by the GSO and the Vietnam Chamber of Commerce and Industry (VCCI) in 10 industries, 60 per cent of enterprises are using technology that is over 6 years of age. Moreover, 65 per cent of these technologies originated from developing countries, of which 26.6 per cent of technology used by Vietnamese enterprises came from China. The proportion of technologies originating in developed countries such as the United States, Korea, Japan or the EU is only about 32 per cent, of which over 18 per cent of using technologies are from before 2005 [5].

Therefore, technological renovation and competitiveness are requirements and vital issues for every Vietnamese enterprise and the entire economy in general, that gives the chance to join the global value chain in the context of economic globalization. Today, there is a technological gap between developed and developing countries. Developing countries, those are lack of STI and dependant on developed countries, still have to import modern equipment and technology from countries with more developed technology[2].

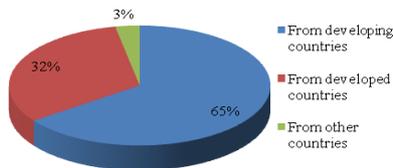


Fig. 2. The proportion of technology transferred by Vietnamese enterprises from other countries. Source: [5]

II. RESEARCH METHOD AND MATERIALS

In this study, authors use comparative research methodology and provide evidence to determine the position of Vietnam on global map of technology and the important role and indispensableness of technology and technology transfer (TT) in socio-economic development. The current status of science, technology and innovation (STI) activities is described to address the ranking and real abilities of Vietnamese researchers and the effectiveness of R&D in Vietnam, which are considered as the cause of the need for TT. In many cases, the author uses statistical analysis methods in comparison with Singapore, Thailand and some other countries in the region to assure the given statements. The lack of relationship between Vietnamese research institutes, universities and enterprises is studied based on the number of patents applied in practice. The study also addresses issues, which enterprises are facing in TT activities through the statistical data and survey results.

The statistical data and materials used in the article are taken from reliable national and international sources of information; objective evidences are cited from official articles, research works, surveys and other statistics documents published in Vietnam and other countries.

III. RESEARCH PROBLEMS AND RESULTS

TT refers to the transition of know-how, skills, technical knowledge or technology from one organizational setting to another [6]. Yooduk Juna and Ilyong Jib defined that TT has been frequently paired with “technology commercialization”, and for this reason TT has occasionally been understood as a sub-part of the latter [7]. Fundamentally, commercialization is the final stage of innovation process. It transforms technology and technique received from innovation activities into a product or process that will gain market acceptance and adoption [8]. Commercialization can also be understood as the process of buying and selling technology, and/or new process, production organization, new marketing and sale methods acquired through the first two phases of innovation process (R&D) to obtain profit [9].

The reality indicates that technological development of Vietnamese enterprises is mainly in two forms: developing their own technology and/or receiving from external source of technology. There are many factors affecting enterprises technology development, and they can be classified into internal and external factors.

A. Internal factors

The Internal factors are the inside problems existed in the enterprise. That is the ability to develop the necessary technology itself.

Nevertheless, we consider that this ability is very low due to the following reasons:

- Most Vietnamese enterprises are small and medium enterprises (SMEs) which do not have or have insignificant scientific and technical staffs involving in STI activities;

Poor awareness of the importance of innovation activities;

- Deficiency of scientific and technical personals, and their limited ability to participate in STI activities and TT;
- Low financial capacity.

The internal factors mentioned above are reflected in the practice of technological development and TT of Vietnamese enterprises. Like many other economies, Vietnamese SMEs (no more than 200 employees under the Law on Small and Medium-Sized Enterprise Support 2018) account for the vast majority. According to the official statistics of the GSO in 2017, the number of SMEs is 495,434, accounting for about 98 per cent of 505,059 acting enterprises [10]. The main STI activities of these enterprises are TT or goods production under license.

There are inadequacy of qualitiveness and quantitiveness of STI personals working in enterprises. According to the survey conducted in 2014, the R&D personal of all qualification is 164,744 persons, of which only 14.4 per cent work in the firms (Fig. 3); nearly 85 per cent (139,531 persons) are occupied in public sector and 15 per cent (20,917 persons) – in private sector. This is unbalanced proportion whereas it is 70 per cent (36,922 persons) and 30 per cent (14,256 persons) in Thailand [11], 46 per cent (16,172 persons) and 54 per cent (18,816 persons) in Singapore [12].

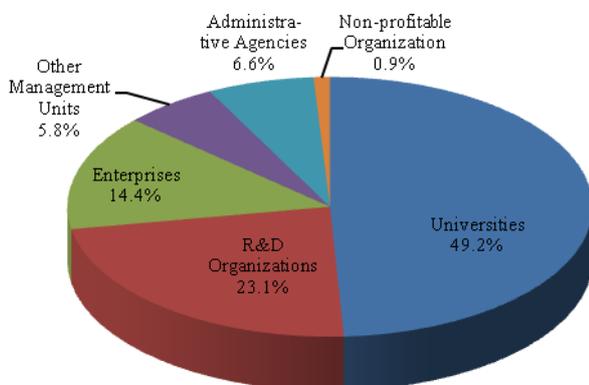


Fig. 3. Percentage of researchers by activity sectors. Source: [13]

A survey conducted by the Research Institute of Vietnam National University (VNU), Hanoi in 2015 shows that among 50 per cent of surveyed enterprises, the percentage of employees involved in STI accounts for only 6-10 per cent of the total employees [14]. The majority of Vietnamese entrepreneurs do not have clear awareness of the importance of technological innovation (Fig. 4). There are only 12 of 583 surveyed enterprises (2%) which have R&D department.

In the period 2010-2012, companies' expenditure on R&D is highly insufficient. According to the above survey, only 4 per cent of enterprises spent more than 10 billion VND on innovation-related activities, 49 per cent – from 1 to 3 billion

VND and 33 per cent – less than 500 million VND. The main costs are payment for TT and consultancy [15].

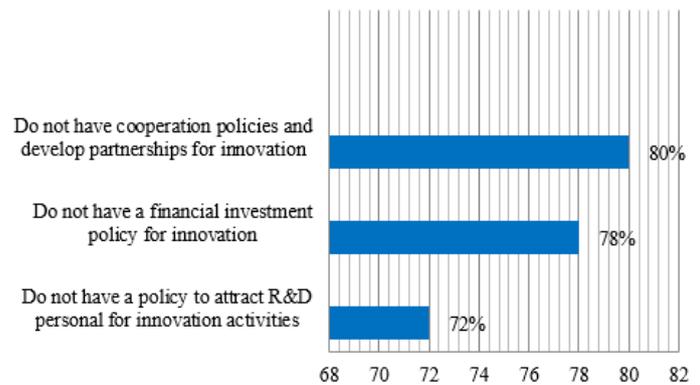


Fig. 4. Understanding of Vietnamese entrepreneurs about innovation. Source: VBM, 2017

Those issues can be explained by the low financial potential of Vietnamese enterprises, as most of them (98 per cent) are SMEs and up to 99.47 per cent operate in the private sector. The enterprises of this type often find it difficult to access state financial support as they do not qualify for subsidized loans or have not enough assets to get mortgage loan from the banks.

TABLE II. NUMBER OF ACTING ENTERPRISES AS OF 31 DECEMBER 2016 BY CAPITAL SIZE AND BY TYPE OF OWNERSHIP

Size of capital (in billion VND)	Total	State owned enterprises	Non-state enterprises	Foreign Invested Enterprises
Total	505,059	2,662	488,395	14,002
Under 0.5	57,181	18	56,589	574
From 0.5 to under 1	53,662	2	53,223	437
From 1 to under 5	204,024	86	202,016	1,922
From 5 to under 10	69,773	99	68,347	1,327
From 10 to under 50	85,253	599	80,657	3,997
From 50 to under 200	23,638	701	19,836	3,101
From 200 to under 500	6,167	442	4,395	1,330
From 500 and over	5,361	715	3,332	1,314

Source: [10, p.363-363].

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B. External factors

The external factor is the national and global technological abilities that meet technology needs of Vietnamese enterprises, and the weakness of the technology market in the country.

The deficiencies due to the characteristics of the enterprises restrict the technological self-development capability of Vietnamese enterprises. Therefore, TT here is an objective inevitability. Typically, enterprises receive technology from universities, research institutes and from other countries, but this type of TT seems to be occasional. The Vietnamese entrepreneurs and foreign - invested enterprises (FIEs) are the main subjects' carrying out TT from

other countries to Vietnam. The data of The National Office of Intellectual Property of Vietnam (NOIP) evidences trends in TT (Table 3&4).

The deficiencies due to the characteristics of the enterprises restrict the technological self-development capability of Vietnamese enterprises. Therefore, TT in this kind of firms is an objective inevitability. Normally, enterprises receive technology from universities, research institutes and from abroad. The Vietnamese entrepreneurs and foreign - invested enterprises carry out TT from other countries to Vietnam. The number of contracts in Tables 3&4 evidences trends in TT.

TABLE III. NUMBER OF REGISTERED LICENSING CONTRACTS IN 2006-2016

Year	Number of registered licensing contracts			
	<i>Vietnamese - Vietnamese</i>	<i>Vietnamese - Foreigner</i>	<i>Foreigner - Foreigner</i>	<i>Total</i>
2006	77 (141)	55 (373)	4 (5)	135 (519)
2007	53 (72)	70 (300)	12 (818)	135 (1190)
2008	132 (260)	76 (477)	33 (103)	241 (840)
2009	74 (98)	65 (387)	24 (146)	163 (622)
2010	69 (147)	60 (399)	16 (71)	145 (617)
2011	64 (73)	54 (281)	25 (156)	143 (510)
2012	89 (198)	45 (169)	8 (208)	142 (575)
2013	109 (152)	46 (144)	9 (45)	164 (341)
2014	90 (188)	104 (461)	22 (166)	216 (815)
2015	95 (251)	85 (612)	23 (106)	203 (969)
2016	118 (240)	89 (455)	18 (362)	225 (1057)

^b Figures in blanket are the numbers of licensed subject matters.
Source: Accessed from NOIP Vietnam [16].

TABLE IV. NUMBER OF REGISTERED CONTRACTS ON PROPERTY RIGHT TRANSFER BY HOLDERS IN 2007-2016

Year	Number of registered assigned contracts on Property Rights Transfer			
	<i>Vietnamese - Vietnamese</i>	<i>Vietnamese - Foreigner</i>	<i>Foreigner - Foreigner</i>	<i>Total</i>
2006	37 (84)	7 (15)	34 (107)	78 (206)
2007	237 (670)	18 (38)	199 (461)	454 (1169)
2008	270 (609)	36 (111)	232 (589)	538 (1309)
2009	604 (1714)	24 (44)	20 (43)	648 (1801)
2010	304 (696)	69 (214)	203 (505)	576 (1415)
2011	325 (693)	37 (153)	179 (820)	541 (1666)
2012	357 (700)	31 (87)	206 (908)	594 (1695)
2013	423 (912)	60 (189)	220 (558)	703 (1659)
2014	456 (1116)	53 (303)	334 (802)	843 (2221)
2015	492 (1413)	49 (174)	307 (827)	848 (2414)
2016	614 (1192)	46 (86)	334 (885)	994 (2163)

^c Figures in blanket are the numbers of assigned subject matters.
Source: Accessed from NOIP Vietnam [15].

Technological capabilities of public research institutes and universities are considered as their ability to develop technology. Kenichi Hatori called technology transfer from universities and public research institutes to private companies

as “academia-industry cooperation” [17]. In Vietnam, the ability to transfer technology from universities and research organizations to enterprises is limited. According to the NOIP, every year, nearly 2,000 science research projects are

implemented by research organizations and another 16,000 – 20,000 by universities, but only 2,000 research results (10 per cent) could be useful to apply to the manufacturing and service sector with less applicable industrial solutions and inventions [18].

World Intellectual Property Organization (WIPO) data shows that in the period of 2007-2016, the total number of patent grants are 10,496, of which Vietnamese (residents) owned 459 (less than 4.37 per cent) the the remaining 9,918 (94.49 per cent) belongs to foreigners (Table 5).

TABLE V. NUMBER OF PATENT APPLICATIONS AND PATENT GRANTS IN 2007-2016

Year	Resident		Non-Resident		Abroad	
	Patent applications	Patent Grants	Patent applications	Patent Grants	Patent applications	Patent Grants
2007	219	34	2,641	691	13	NA
2008	204	39	1,995	627	14	2
2009	258	29	2,632	677	6	2
2010	306	29	3,276	793	19	4
2011	300	42	3,260	958	22	5
2012	382	52	3,423	1,016	44	4
2013	442	59	3,552	1,123	54	11
2014	487	36	3,960	1,361	74	24
2015	582	63	4,451	1,325	100	25
2016	560	76	4,668	1,347	73	42
Total	3,740	459	33,858	9,918	419	119

Source: World Intellectual Property Organization (WIPO), Statistical country profiles, 2017.

The analysis of data in Table 5 let know that the number of applications for patent has increased almost two-times from 2,873 in 2007 to 5,301 in 2016, averaging nearly 18.5 per cent annually, but the ratio between the number of applications for patents and granted patents notably is less than that in Singapore. For example, Vietnam had 5,301 applications as of 2016, of which 1,465 were granted, achieving a performance rate of 27.63 per cent. Similarly, this proportion in Singapore has accounted for 62 per cent (Fig. 5). As a result, the R&D of Vietnamese researchers is not effective.

These figures demonstrate the low capacity of R&D of Vietnamese scientists that do not meet expectations and show the technology gap between Vietnam and the World. The promotion of innovation research in the country and the TT from other countries are inevitable in the current context of technology level in Vietnam.

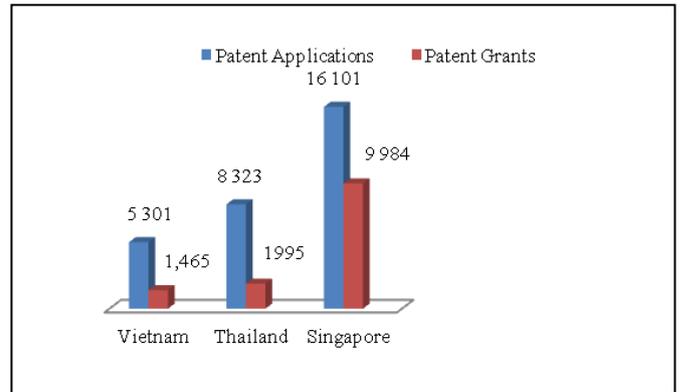


Fig. 5. Total number of Patent applications and Patent grants in Vietnam, Thailand and Singapore in 2016. Source: accessed from WIPO, 2018. Statistical Country Profiles

The data of Table 6 exposes the effectiveness of R&D activities and the problems that require in-depth study: the proportion of granted utility solutions and inventions made by the public sector including universities and research institutes from 2011 to 2015 was 18.58 per cent, while the number of researchers working in these organizations accounted for 72.3 per cent of the total (Fig. 3). In the contrastive situation, Vietnamese enterprises, individuals and others have made 81.42 per cent of the total granted patents, while there were only 15 per cent of total researchers working in private sector.

TABLE VI. PATENT GRANTED FOR VIETNAMESE UTILITY SOLUTIONS AND INVENTIONS OF VIETNAMESE BY HOLDER IN 5 YEARS 2011-2015

Year	Others		Individuals		Enterprises		Universities		Research Institutes	
	Utility solutions	Inventions	Utility solutions	Inventions						
2011	3	1	16	17	24	16	1	4	2	4
2012	0	0	28	21	18	11	4	6	9	6
2013	0	2	29	30	25	20	6	0	14	0
2014	5	2	23	24	26	4	4	2	13	2
2015	5	2	33	31	28	16	4	4	16	4
Total	13	7	129	123	121	67	19	16	54	16

Source: collected by author from Annual Report on Intellectual Property Activities 2011, 2012, 2013, 2014 and 2015. NOIP, Vietnam.

Considering the above mentioned analysis we can conclude that the ability of TT from research institutes and universities to enterprises is limited. Conceivably, the causes could be:

- 1) The research works did not focus on key areas and priority projects; the effectiveness of R&D is low;
- 2) The R&D activities have not been linked to the reality of domestic production and business demands and do not grasp the technology requirements trends of manufacturing and service sectors, i.e. the relationship between the public research sector and enterprises is not tight;
- 3) Qualifications of research staff do not meet the requirements of R&D.

Due to the weakness in technological development in the country, Vietnamese enterprises are being forced to receive technology from other countries. From 2010 to 2017, the number of registered contracts on licensing and property rights transfer between Vietnamese and foreigners accounted for 828, and between FIEs and foreigners accounted for 1,577 [15]. However, large technological readiness level between recipient countries and investing countries, and limitation of financial capability slow down the process of TT. According to the Ministry of Science and Technology (MOST), there were only 115 contracts fully completed with total estimated value of VND 447,000 billion VND, in which 02 contracts on TT of Samsung Corporation in 2017 worth about 323,000 billion VND [19]. As a result, the success rate is slow.

We assert that FIEs play an important role in attracting and transferring technology. However, the efficiency of the TT implemented through FDI channels has not met expectations. The MOST' statistics reported that in 2012, the number of FDI projects using high technology in Vietnam is low in comparison with other countries. Only 5-6 per cent of FDI projects in Vietnam use advanced technology; over 80 per cent of FDI projects use average technology; and about 14 per cent of FDI enterprises use low and out-dated technology [20].

Technologies transferred under the FDI projects mainly serve the interests of investors, so it may lead to:

(a) the problem of environmental pollution, carbon emissions;

(b) obstructing technological diffusion due to know-how protection;

and (c) highly defined technology value that is out of control of the State authorities and used by investor as method of "transfer pricing" (TP) between enterprises under common ownership.

Foreign investors try to use partner' import dependency on technology, materials and components as a way to evade income taxes. When making capital contributions with technology in investment projects, parent companies often declare technology or material with value higher than they really are. Then, the subsidiaries transfer that value to the parent company in the form of depreciation, creating real interest and fake losses to evade the corporation income tax payment annually. The same problems have occurred in Vietnam. For example, in Ho Chi Minh City, 90 per cent of FIEs operating in the textile and garment industry have unprofitable business report. However, these FIEs continue to invest in production expansion announcing losses in business. The case of Coca-Cola Vietnam is another example of suspicious TP. For more than 20 years of operation in Vietnam, until September 30, 2011 the Company continuously had reported on losses, which reached up to 3.768 billion VND (approximately 210 million US dollars), exceeded the initial investment capital (2,950 billion VND). Due to the claimed loss, Coca-Cola was exempt from corporation income tax in accordance with the Vietnam Legislation, but its income actually continues to grow at a rate of 20-30 per cent per year and the company plans to invest 300 million USD in new projects in Vietnam [21].

One of the reasons that affect the TT to enterprises is that the technology market in Vietnam has not yet developed. Man N.L. (2017) in his research "Technology Market Development in Vietnam" pointed out that the weakness of the technology market is caused by the following reasons:

(a) incomplete legal framework;

(b) the lack of knowledge from the Vietnamese enterprises about technology source;

(c) limitation of R&D results that may be transferred from research institutes and universities to enterprises;

(d) undetermined true value of the R&D results ;

and (e) underdeveloped information and service systems [22].

IV. RECOMMEDATIONS

Recognizing the important role of technology development, the State has developed comprehensive solutions to address issues related to STI activities that have been institutionalized in the Laws and the Strategies, National Development Programs, such as:

- Law No. 07/2017/QH14 on Technology Transfer 2017;
- Law No. 29/2013/QH13 on Science and Technology;
- Law No.19/VBHN-VPQH on Intellectual Property 2013;
- Law No. 21/2008/QH12 on high technology 2008;
- Law No. 04/2017/QH14 on supporting small and medium-sized enterprises;
- Strategy for science and technology development in the 2011-2020;
- Industrial Development Strategy through 2025, vision toward 2035;
- National Technological Renovation Program up to 2020, etc.

State policies create conditions and great opportunities for the technological development of the country and technological renovation for Vietnamese enterprises. However, there remain problems that have arisen when analyzing the internal and external factors, affecting TT. In this study, we suggest some solutions that may be useful to overcome inadequacies discovered in the enterprises' business practice.

1) Solving problems related to R&D human resource and the relationship between enterprises, R&D institutes and universities

- Restructuring science and technology human resources and attracting R&D staffs into manufacturing sector;
- Encouraging the cooperation and creating regulatory environment for spin-off between enterprises, R&D institutes and universities are the most common solutions by allowing a large number of researchers to join the researches and helping enterprises to absorb new technology;
- Providing knowledge of innovation for staffs of R&D organizations to increase the effectiveness of research works; universalizing theory of innovation management for universities and colleges students;
- Encouraging international cooperation in science; consulting and assisting Vietnamese scientists to public their researches on international-standard publications.

2) Funding for STI

- Continuing to increase spending on STI activities as stated in The Strategy for Science and Technology Development for the period of 2011-2020: to reach Gross domestic expenditure on R&D (GERD) of 1.5 per cent GDP in 2015 and over 2 per cent GDP in 2020, focusing on innovation projects. In the period 2011-2016, an average GERD was nearly 0.5-0.6 per cent GDP [19];
- Providing tax preference reserved for TT and import of research and production equipment as stated in different documents such as Law on High technology, Law on Intellectual property, Law on Investment, Law on supporting small and medium-sized enterprises;
- Supporting start-ups and other enterprises in financing innovation activities by the form of loan provision, credit guarantee, preferential corporate income tax, land rental preferences, technology renewal, training, counseling, or human resource development;
- Improving the accessibility of investment Funds established by the Government such as National Technology Innovation Fund, National Science and Technology Development Fund, Hi-tech Venture capital Fund.
- Attracting investment in enterprises' STI activities through venture capital funds and stock market; providing consult action and services for STI;
- Encouraging and supporting research funding for individuals participating in STI fields

3) Improving the access to Innovation resources

- Simplifying administrative procedures and clarifying financial requirements from support funds; facilitating enterprises to participate in national cooperation programs (science forums, technology fairs, international consultants, etc.);
- Completing system of legal documents Government policies related to STI;

4) Completing the database of Science and technology

- Building national database under The Circular 10/2017/TT-BKHCN on Science and Technology and Innovation; regularly update information about new technologies in Vietnam and around the World; facilitating enterprises and clients who are willing to access information about technology;
- Establishing a reporting regime for the STI output as part of the statistical report.

V. CONCLUSION

Technology is the result of STI activity. The technological potential of the country depends on STI activities and plays an important role in the process of technological renovation and enhancing the competitiveness of enterprises. The National Technological Renovation Program up to 2020 targets that in 2020 100% of enterprises will manufacture key products and national product and master the advanced production technology. The goal of the Strategy for Science and Technology Development for the 2011-2020 periods is that in 2020 hi-tech products and hi-tech application products will account for the value of 45% GDP. Reaching the targets requires sustained efforts of the state, scientists' and business community for technological development.

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