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ДАО Тхань Чіонг, доцент, доктор

декан факультету менеджменту Інституту політики та менеджменту
Коледж соціальних та гуманітарних наук при В'єтнамському національному
університеті (Ханой, В'єтнам)
e-mail: truongkhql@gmail.com

НГУЕН Ван Кхань, професор, доктор

Інститут політики та менеджменту
Коледж соціальних та гуманітарних наук при В'єтнамському національному
університеті (Ханой, В'єтнам)

ДАНГ Кім Кхань Лі, доктор, факультет соціології

Коледж соціальних та гуманітарних наук при В'єтнамському національному
університеті (Ханой, В'єтнам)

НАУКА І ТЕХНОЛОГІЯ У ЗРОСТАЮЧІЙ ТЕНДЕНЦІЇ ІНТЕГРАЦІЇ ТА ГЛОБАЛІЗАЦІЇ: ТЕМАТИЧНЕ ДОСЛІДЖЕННЯ В'ЄТНАМУ

XXI століття відзначається помітною тенденцією у світовому розвитку, а саме поглибленням економіки знань, економічної глобалізації та інформаційного суспільства. Основою для цього дедалі більш активного перетворення є значне піднесення науки і технологій (НІТ) у багатьох галузях, особливо в інформаційних технологіях. Революція в галузі науки та технологій, а також інновації в галузі освіти та професійної підготовки створюють багаторівневі шляхи співпраці між різними країнами.

У цьому контексті стратегія розвитку В'єтнаму потребує розвитку науки та технологій, а також освіти та професійної підготовки, які розглядаються як національні пріоритети та ключові мотиватори сталого розвитку. Проте як країна наздоганяю чого розвитку В'єтнам зіткнувся з цілою низкою труднощів і проблем на шляху інтеграції та глобалізації.

Таким чином стратегічна дорожня карта має вирішальне значення для успішної міжнародної інтеграції, упровадження передових наукових і технічних розробок та стратегій розвитку освітнього процесу, що сприятиме індустріалізації, модернізації та сталому розвитку країни¹.

К л ю ч о в і с л о в а : наука, технології, освіта, навчання, В'єтнам, глобалізація, інтеграція

DAO Thanh Truong, Assoc. Prof. Dr. Dean, Faculty of Management Science, Institute of Policy and Management, University of Social Sciences and Humanities, Vietnam National University Hanoi, Vietnam

NGUYEN Van Khanh, Prof., Institute of Policy and Management, University of Social Sciences and Humanities, Vietnam National University Hanoi, Vietnam

DANG Kim Khanh Ly, Dr., Faculty of Sociology, University of Social Sciences and Humanities, Vietnam National University Hanoi, Vietnam

SCIENCE AND TECHNOLOGY IN THE RISING TREND OF INTEGRATION AND GLOBALIZATION: A CASE STUDY OF VIETNAM

The 21st century witnesses a noticeable trend in world development, that is, the advancement of the knowledge economy, economic globalization and information society. The basis for this

¹ Дослідження виконано як частину національного проекту 2016–2018 рр. "Політика щодо управління соціальною мобільністю висококваліфікованих науково-технічних кадрових ресурсів у міжнародній інтеграції" (код: КХ.01.01/16-20) у рамках Національної ключової науково-технічної програми на 2016–2020 рр. "Дослідження з ключових питань соціальних та гуманітарних наук для соціально-економічного розвитку", В'єтнам.



rising transformation is the significant upsurge of science and technology (S&T) in many fields, especially in the information technology. The S&T revolution, together with innovations in the field of education and training, has been making ways for cooperation among countries across many levels.

As a result, the development strategy of Vietnam has regarded S&T development and the advancement in education and training as national priorities and key motivations for sustainable development. Nevertheless, as a latecomer, Vietnam has seen a number of difficulties and challenges in the integration and globalization trend.

A strategic roadmap, therefore, is critical for a successful international integration, implementation of S&T, as well as educational training development strategy, contributing to the industrialization, modernization and sustainable development for the nation².

Key words: science, technology, education, training, Vietnam, globalization, integration

Introduction

The world is operating in times of the fourth industrial revolution. The revolution has been changing the fundamental of modes of production, thereby creating another "revolution" in the organization of chain-value production. The intensity and scope of such changes foreshadow the drastic transformation of the entire production, management and governance systems of human society. The S&T development in the fields of artificial intelligence, Internet of things, big data, 3D printing technology, nanotechnology, biology, new materials, etc. is both the driving force, and the supporting environment for the implementation of the Fourth industrial revolution.

Since the last decades of the 20th century, the world economy has been following two overarching trends, namely development of *knowledge economy* and *economic globalization*. Knowledge economy is dependent upon a production force with significantly higher capacity in comparison to that in an industrial economy; within a knowledge economy, understanding on S&T and human skills is the determinant factor of production- the most important production force. Such factors have become the direct motivation for all changes in the socio-economic life through creation of new production industries with new technologies, new methods of manufacturing, new materials and new sources of energy. S&T knowledge is the absolute requirement for workers.

Structural changes of the world economy lead to market alteration, with high content of technology and progressively expansive service market. It is foreseen that within the 21st century, the service sector may experience a 70-80% increase in terms of working force while the industrial sector will decrease correspondingly; the proportion of product manufacturing with high level of S&T content will increase while that of intermediate S&T sector will drop.

The world labor market in 2011-2020 will be influenced by economic globalization and demographic change. Globalization makes national and regional mobilization easier for workers. The Asia-Pacific region is still the largest hub for labor in the world. Besides, the growth in world population over the period 2011-2020 is more moderate and mainly restricted in developing countries; thus, the primary labor force for the world economy clusters in these countries. This results in an increase in immigration from low-growth economies to higher-growth economies³.

² This paper is a research outputs of the national-level project from 2016-2018 named "Policy to control social mobility of high quality science and technology human resources in the international integration" (Code: KX.01.01/16-20) in the framework of National key science and technology program for 2016-2020: Researches on key issues in social sciences and humanities for socio-economic development, Vietnam.

³ In general, over the period 2011-2020, the world economic forecast highlights these outstanding issues:

- Globalization of the world economy is happening at an incredible pace.
- The continuous expansion of bilateral, regional and multilateral economic connections promotes development of the regional and world economies.
- S&T is more and more successful in affirming its role as a dominant factor to the world economy.



In fact, the world economy over the years has seen through slow and unstable growth, despite few positive signals. 8 years after the global economic crisis (in 2008), the world economy has not regained its initial momentum. The overall growth rate has yet to reach its forecasted figure, but, basically, it can be seen that the effects of financial crisis and public debts are no longer severe, the world economy is slowly adapting to political-security fluctuations⁴.

Although, in comparison to the year 2015, the 2016 growth rate had a slight upturn, many difficulties and challenges are set forth for the world economy. The attempt to recover the world economic growth will continue to encounter several risks due to unpredictable fluctuation in the financial, monetary, crude oil, stock markets and volatile prices of strategic commodities; increasing political instability, terrorism, immigrant crisis, natural disasters, epidemics, climate change in some areas, etc.

Information society has become a major form of modern society, and no single sector is separable from information, it has become one of the five economic elements (human resources, materials, techniques, capital, and information). The amount of information and the speed at which information is communicated represents the strength of a country. General management and information are two closely related areas. In terms of structure, information is an intrinsic part of management⁵.

The S&T revolution motivates the restructure process of the world economy, internationalization of economy and social life. Nowadays, the cycle of applying scientific research results in practice is shortened, information has become a resource, a real property that will continuously change and develop. In this sense, education and training is considered as the beginning of a constant, lifelong learning process. Education has become a diversified, flexible system for the majority, yet based on the ground of differentiation and self-training, it focuses on individual capacity and potential⁶.

In the trend of international integration, according to the theory developed by Christopher Thill, within the era of "post-scientific society", organization of onsite scientific research activities might be efficiently replaced by applying new scientific knowledge [3]. Such scientific knowledge is the basis for societal reformation, not only in theory, but also in form of underlying knowledge in any system or procedure innovated anywhere in the world. Also, an underkill's perspective, the new science needs fewer scientists than a scientific society requires. Income would be the leading issue, while companies, enterprises in a post-scientific society will "hire" fewer sci-

- The world economy still pertains many underlying risks such as the expansion boom of developing economies, increasing demand for energy which has a negative impact on natural resource reserves and living environment.

- World economic activities are gradually shifted to the Asian region, turning it into a new world economic hubbeside other developed economies like America, EU, Japan.

- Developing countries prove their increasingly important roles in the development of the world economy.

⁴ The world economy in 2015 demonstrated these following traits: - In many countries and regions, the economy showed uneven, unstable and unsustainable development; - The international financial – monetary market underwent complex and unpredictable fluctuations, which had a negative impact on world economic stability; - The remarkable drop in oil and raw material prices created burden on major oil and material exporting countries. For countries dependent upon exporting oil, the decline in oil prices had unfavorable effect on the overall revenues and economic growth of such countries; - The increasingly severe confrontation between regionalism and multilateral cooperation was detrimental to the progress of globalization and world economic development. Only in 2015, WTO received 13 announcements on establishment of new Regional Trade Agreements (RTAs). As a result, the total number of ongoing RTAs skyrocketed to 265 [1].

⁵ Certain experts consider knowledge as "added value"; even in identifying characteristics of a knowledge society, one tend to attach "information" with "knowledge" to determine the nature of a society. Knowledge is a source of power, and many people still regard knowledge personal as a form of security. Without proper measures to encourage sharing of information and knowledge, such information-knowledge society will not be able to persist.

⁶ Any degrees and diplomas are only valid for a certain period of time, whereas capacity certification in future is fully dependent upon self study, self perfection in the face of rapid change and development of modern S&T [2].

entists. The role of academic researchers will be more inclined to transfer and exploitation of new knowledge than concentration on enriching the existing scientific knowledge library⁷. Enterprises will be less involved in commitment for long-term investment on fundamental research and become more reliant on third-party knowledge providers [5, 6].

In a post-scientific society, the innovation process and hatching of new ideas will be less dependent upon social scientific & technological contributions, while mainly counts on social and organizational sciences, arts, business secrets, the ability to provide products and services that fully meet customers' needs rather than products offered at low costs and with completely novel technology applied.

Thanks to great S&T achievements, especially in the fields of information technology – communication, material science, etc., human society is in the transition from industrial civilization to an information era, from an economy depending on natural resources to an economy operating on knowledge, opening up new opportunities for developing countries to shorten their industrialization and modernization phase. The power of each nation is greatly determined by its S&T capacity. Advantages of natural resources and cheap labor are becoming of less importance. Human resources with professional qualifications and creativity have an increasingly decisive role in the context of economic globalization⁸.

Developing countries with certain level of S&T and economic development are sure to make remarkable developmental leaps within such enabling environment that S&T globalization brings about, - on condition that they grasp opportunities, make critical decision on priority areas, increase in initial renovation and import, consumption, absorption, renewal. In reality, there are some countries and territories like Korea, Taiwan, China, Brazil, India, etc., which were still classified as developing countries not long ago, yet they have surged to be among the leading technological suppliers in certain areas.

S&T, education & training situation in Vietnam in the integration and globalization trend

Chances and challenges in the path of international integration

In the 11th National Congress (in 2011), Vietnam affirmed: *"the intensive development of science and technology as a motivation to accelerate the industrialization-modernization process, develop a knowledge economy, contribute to the rapid increase in productivity, quality, efficiency, competitiveness of the economy, and also, the progressive and sustainable development of the country"*⁹.

It can be seen that, per capita GDP of Vietnam (in USD) has been constantly improved in recent years. In 2013, GDP per capita was only 1,900 USD, but the figure was estimated approx. 2,200 USD in 2016. Together with it, the expansion of the financial system and the consumption of luxurious goods, etc. are quite notable. It is expected that, in 2016-2020, the average economic growth rate will be 6.5-7%/year. The average GPD price index is forecasted to increase by 6.0-6.5%/year. The average rise of the VND/USD exchange rate is 2-3%/year. Population will grow by about 1%/year,

⁷ Thomas Kuhn in discussion on scientific progress [4].

⁸ The time needed for putting research results into application and the life cycle of technology is shortened over time. Competitive advantages are with enterprises that take advantage of new technology to create new products and services that meet the diversified and constantly changing needs of the customers. With strong financial and S&T potentials, transnational and multinational companies have influential and dominant impact in the market of advanced technologies.

⁹ See more: [7].



and reach 96.1 million people in 2020¹⁰. Nevertheless, the index measuring the level of national knowledge economy remains very low, below the average point¹¹ etc.

The fact that Vietnam became a part of regional and global institutions, economic and financial organizations, especially the WTO, creates massive chances to approach markets in all other member countries. Vietnam has the condition to expand its export market, slowly extending its service business further beyond national borders.

Regarding the economic sector, Vietnam's integration is becoming progressively profound. This is a critical premise to bring forward the full potentials of all economic players within the country. This is also the opportunity to attract more foreign investment, to ensure a more sustainable growth rate and narrow the developmental gap. The integration into the world also helps promote national renovation, ensure a more uniform and effective process that makes a great driving force for socio-economic development and contributes to the development of legislative power.

However, in this process, international integration in Vietnam also faces major challenges. While the country is still dealing with several difficulties set forth for an emerging nation, coming out from wreckage of the war, and the fact that renovation has not brought about any breakthrough, etc. All of these constitute a "double challenge" for Vietnam.

The dramatic development of the S&T revolution in the world can widen the economic and knowledge gap among countries, leaving Vietnam at risk of further lagging behind. Possible export of poor-quality education from other countries can pose significant risks for Vietnam, while the capacity to manage transnational education remains inadequate, etc. Obviously, in order to boost economic development in the upcoming decade, strict requirements for highly qualified human resources are essential. The demand for trained labor in terms of both quantity and quality with rational arrangement is progressively increasing, which constitutes great pressure on education [9].

Strategy for development of science, technology and education in Vietnam

For years, Vietnam has always spoken highly of the notion that "*Education and training, together with science and technology is the preeminent national policy, the driving force for any development process*". In practice, however, the objectives and perspectives of science, technology and education have not been fully understood for effective implementation in all areas and at various levels of policy enforcement [9].

¹⁰ By 2020, in low case scenario (the average growth in GDP is 6.5%/year, average GDP price index is 6%/year, VND/USD currency exchange is 3%/year), GDP (at 2020 price) will be about 7,695 trillion VND, equivalent to approx. 307.5 billion USD. At that time, per capita GDP will be about 3,200 USD/head.

In a favorable case scenario (the average growth in GDP is 7%/year, average GDP price index is 6.5%/year VND/USD currency exchange is 2%/year), GDP (at 2020 price) will be about 8,075 trillion VND, equivalent to approx. 336.4 billion USD. At that time, per capita GDP will be about 3,500 USD/head.

Thus, with the expected economic growth rate, the rise in GDP price index and VND/USD currency exchange and population for the period 2016-2020, per capita GDP by 2020 will fall between 3,200-3,500 USD.

"Additional assessment on implementation of the socio-economic development task in 2015, the implementation result over the span of 5 years, from 2011-2015 and the plan for socio-economic development in 5 years, from 2016-2020" (Government gazette presented by Vice Prime Minister Nguyen Xuan Phuc at the 11th Session, 13th National Assembly on March 21st, 2016).

¹¹ According to The World Bank's (KEI) Knowledge Economy Index (2012), Vietnam ranked 104 out of 143 countries and territories, 9 ranks higher than in 2000; In comparison to other countries in Southeast Asia, Vietnam is above 4 countries: Indonesia, Laos, Campuchia, Myanmar. According to WB ranking, among the four pillars (institution – business environment, innovation system, education – human resources, information technology – telecommunication), Vietnam scores lowest in terms of institutional–business environmental indicator, whereas its information technology–constitution is the highest (Roundtable under the framework of the state-level project "Development of a knowledge economy by 2020", code 06-2012/ĐTĐL conducted on May 26th, 2015). The labor productivity of Vietnam, despite its slight increase (the average productivity growth rate in 2001-2010 was about 4.8 %/year), is still about 2.6 and 4.3 times lower than that of China and Thailand, respectively [8].

For realization of the development strategy, many S&T plans have been completed, such as the medium-term planning for 2011-2015, the National technology innovation program, the High-tech development program, the National product development program, the S&T market development program, etc. These are major programs that can strongly affect the potential and level of S&T in Vietnam, further accelerating international S&T integration, which then contribute greatly to the economic development rate and quality and promote rapid and sustainable development for the country.

S&T international integration in recent years has contributed to strengthening technical facilities for scientific research and development organizations, enhancing staff capacity, promoting national technological renovation. In reality, however, national S&T human resources is insufficient to effectively participate in national and regional S&T activities; the level of contribution to international and regional S&T activities remains low. Institutions and universities of scientific research and technological development do not have the capacity and conditions to promote expansion of international integration activities [10].

In response to new requirements set forth by the new situation, the Party and Government of Vietnam have adopted several important policies while continuing to develop and complete policies to promote S&T international integration. The 2011-2020 Socio-Economic Development Strategy indicated that S&T development must truly become a key driver of development.

2014 was considered the "year of action" of the S&T sector with eight Decrees and 52 Decisions issued by the Prime Minister and other guiding circulars, which contributed to the improvement of the S&T legal system, and the Legal framework for S&T activities.

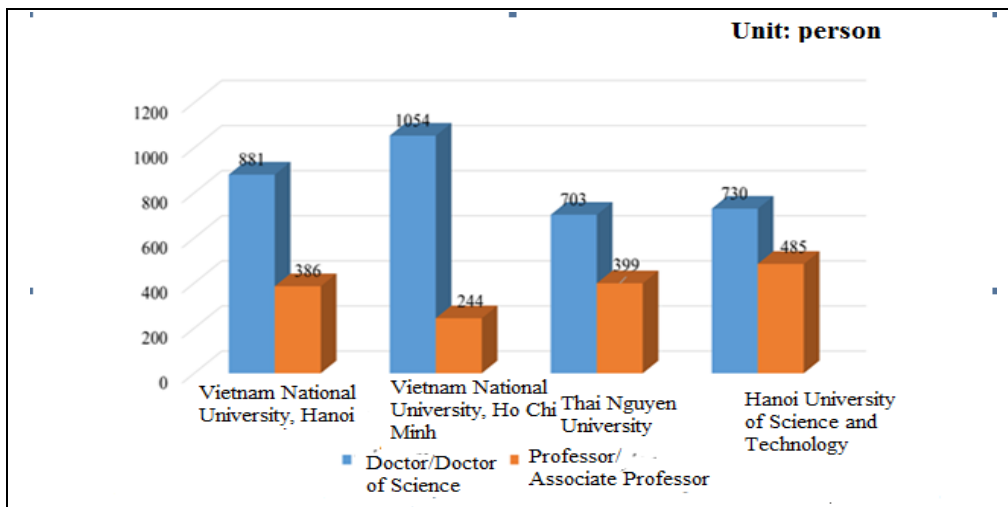


Fig. 1. The number of scientific staffs attaining Doctor/Doctor of Science degree or Professor/Associate Professor title¹²

S&T activities in Vietnam in 2014 were summarized based on the survey on people's awareness of S&T (conducted for the first time in Vietnam)¹³. Results revealed

¹² Study survey data KX06.06/11-15: Research, analysis of scientific system, technology and renovation/innovation in Vietnam in the trend of S&T international integration.

¹³ Regarding means of collecting S&T information, television is the most common at 19%; following is internet with 17%; collection through newspaper channel is 15%. In terms of access to S&T knowledge, 81% of respondents are knowledgeable about chemotherapy, 86% biotechnology, 89% solar energy, 77% e-commerce, 84% greenhouse effects, 95% air pollution, 84% ozon hole, 98% bird flu (H5N1, H7N9), 75% cloning, 45% broadband, 61% interna-



that 88% of respondents said that increased investment in S&T was essential, and only 2% of respondents thought there was no need for such increase in S&T investment. According to the survey results, 90% of respondents also rated S&T as very important for production and life. At the same time, most of these ideas also suggested that Vietnam needed such scientific knowledge to make our daily lives better.

With regards to educational strategy, Resolutions of the 11th National Party Congress (2011) affirmed that "Among fundamental and comprehensive reformation of the Vietnamese education system in the direction of standardization, modernization, socialization, civilization and international integration, renovation of educational management mechanism, together with development of forces of teachers and management administrators in education is a pivotal step "and "education and training, with the mission of raising people's intellectual standards, development of talents, contributes greatly to the course of national development, including Vietnam's culture and people". The economic development strategy for the 2011–2020 period is all about: "Development and improvement of labor capacity, especially highly qualified human resources shall be a strategic breakthrough"¹⁴.

He needs to develop in students 8 core qualities and competencies: **Compassion - Tolerance, Diligence - Conservation, Responsibility - Discipline, and Honesty - Bravery**. These words become memorable "slogan" for people, which carry underlying meaning; for example, tolerance is not just forgiveness, but also means showing respect to differences; bravery is not only courageous in combat but also confident in cognition - being critical in thinking and dare to defend righteousness, etc. In addition, the three general capabilities that should be developed through every subject and educational activity are:

- Self-reliance expressed in every individual's relationship with himself.
- Cooperative capacity reflected in every individual's relationship with others.
- Creativity revealed in every individual's relationship with his work.

The second group includes specific competencies developed through one or some certain subjects, such as:

- Language using (closely associated with Literature, Foreign language).
- Aesthetics (closely associated with Arts).
- Computation (closely associated with Mathematics and natural sciences), computer competency and physical ability.

The S&T revolution, especially in terms of IT and communication, will create favorable conditions for fundamental renewal of content, methods, and form of organizing education, educational management reform towards e-learning to meet the needs of individual learners. The global integration in education is taking place on a global scale, creating favorable conditions for access to new trends, knowledge, modern educational models, taking advantage of external resources, and creating opportunities for educational development [12]. Over the last two congresses of the Party, Vietnam has emphasized the importance of S&T as *decisive to national competitive advantages and the rate of development* of the entire process of industrialization and modernization associated with the development of knowledge economy; the nature of industrialization and modernization is S&T development [13, p. 112].

tional space station, 53% cloud computing, 92% climate change, 89% rising of sea level, 78% genetically modified organisms and 59% earthquake stimulation. This shows that the public is well aware of issues related to pollution of the environment, epidemics and climate change. Survey results also revealed the level of awareness of most respondents on S&T issues was correctly reflected. Figures provided by Le Xuan Dinh, Head of the National Agency for Science and Technology Information in the interview with *Truyenthongkhoahoc* newspaper [11].

¹⁴ Educational development in 2011-2020 (Issued in conjunction with Decision No. 711/QĐ-TTg on June 13th, 2012 by the Prime Minister). See more at [12].

Current situation of S&T, education & training in Vietnam

Despite certain achievements, the general situation of S&T in Vietnam still has many weaknesses. There still exists quite a gap between Vietnam and other countries in the world and in the region; current S&T has not yet met the requirements as the ground and motivation for socio-economic development.

The S&T management mechanism is not responsive to reformation and is administratively focused, which is reflected in the fact that the management of many S&T organizations is conflicting with the nature of creative labor and the socialist-oriented market economy. S&T organizations have not got the full autonomy in planning, finance, human resources and international collaboration to promote their dynamism and creative. The S&T market is developing slowly. The market for technology and circulation of S&T research results is restricted due to the lack of intermediaries, brokers, and necessary legal regulations, especially an effective system for protection of intellectual property rights.

Inadequate research results are reflected in the limited number of granted patents. From 1981 to 2015, in Vietnam, there were 7511 applications, of which, only 1552 were granted patents, accounting for 20.26%. Particularly in universities, the number of applications and patents granted was even much lower than the average national figures. From 1986 to 2014, there were 153 applications from different universities in Vietnam, of which, only 37 were granted patents, accounting for 24.28% [14]. In the field of fundamental and applied research, the number of international publications, especially on ISI and Scopus journals was very low.

According to National Agency for Science and Technology (NASATI), the total number of S&T publication in the country in 2015 was up to 200.000 articles. Over the past few years, the number of scientific articles published every year has slightly increased, reaching 18,630 articles in 2015.

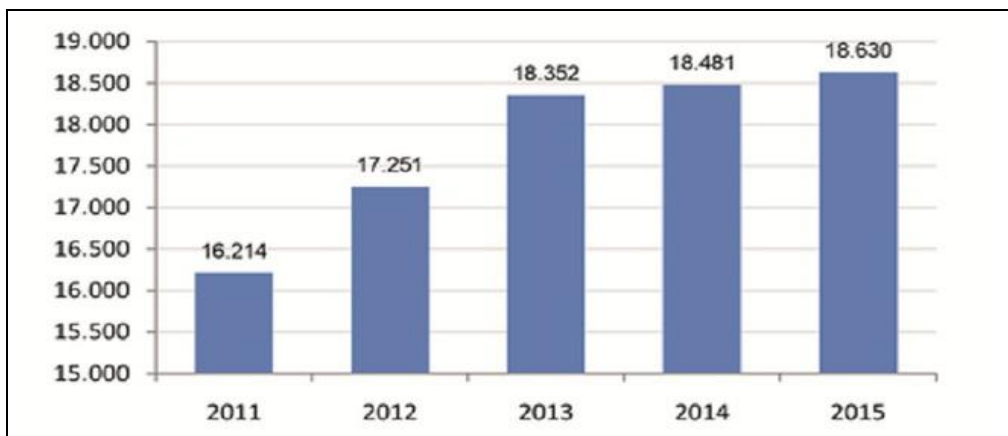


Fig. 2. The number of S&T articles published by Vietnam (2011-2015)¹⁵

The number of S&T publications on reputable international S&T journals is used by many countries as indicator for S&T productivity appraisal.

The total number of S&T publications of Vietnam in 2011-2015 as reflected in Web of Science database was 11,953 articles. For the first time, in 2015, the number of Vietnamese publications inputted into Web of Science database got over 3,000 articles/year and reached 3,137 articles (increased by 13.7% in comparison to the previous year), almost double the figure of the first year in the whole period.

¹⁵ National Agency for Science and Technology, accessed Web of Science on March 31st, 2016.



The number of S&T international publications of Vietnam in the Web of Science database showed that physics, mathematics, chemistry, and technology are the fields of competency of Vietnam. These four areas of expertise accounted for over 44% of the number of S&T international publications of Vietnam.

Table 1. The number of international publications of Vietnam (2011-2015)
(Source: Web of Science database¹⁶)

Year	The published number	Growth rate (%)	The extraction time	The average extraction per publication	The average extraction per year of a publication
2011	1.584	-	12.917	8,15	2,04
2012	1.964	23,99	16.509	8,41	2,80
2013	2.509	27,75	12.593	5,02	2,51
2014	2.759	9,96	7.662	2,78	2,78
2015	3.137	13,70	2.413	0,77	
<i>Total number</i>	<i>11.953</i>				

Table 2. The top twenty fields of research in Vietnam with high numbers of international publications (2011-2015)¹⁷

Cardinal Number	Majors	Published Number	Rate in total
1	Physics	1.551	12,9
2	Mathematics	1.326	11,0
3	Engineering	1.233	10,3
4	Chemistry	1.231	10,2
5	Material Science	1.037	8,6
6	Environmental and ecological science	613	6,3
7	Pharmacy	507	5,1
8	Public Environment Occupational Health	502	4,2
9	Infectious Disease	477	4,2
10	Computer Science	446	4,0
11	Agriculture	403	3,7
12	Botany	387	3,3
13	Molecular Biology, Biochemistry	341	3,2
14	Veterinary	318	2,8
15	Biotechnology, micro-organism application	287	2,6
16	Food technology	262	2,4
17	Microbiology	247	2,2
18	Immunology	243	2,1
19	Geography	231	2,0
20	Economy	217	1,9

Fields that have the highest numbers of international publications are Mathematics, Physics, and Chemistry – accounting for one third of the total number of international publications of Vietnam. Additionally, 20 S&T organizations with the majority of international publications (in order) are: Vietnam Academy of Science and Technology, Vietnam National University – Hanoi, Vietnam National University – Ho Chi Minh City, Hanoi University of Technology, Hanoi University of Education, Hanoi Medical

¹⁶ National Agency for Science and Technology, accessed Web of Science on March 31st, 2016. Research on quantitative variance and quality assessment of S&T publications – an important output of S&T activities called bibliometrics. One of the earliest and most widely used bibliographic databases in the world is the Thomson Reuters Web of Science (formerly known as the ISI database).

¹⁷ National Agency for Science and Technology (extracted and processed information from Web of Science database, March 31st, 2016. These figures might change since Web of Science has not updated all data in 2015).



University, Can Tho University, National Institute Of Hygiene And Epidemiology, Hue University, Vinh University, Ho Chi Minh City Medicine and Pharmacy University, National Hospital of Tropical Diseases, Vietnam National University of Agriculture, Hanoi University of Public Health, Ho Chi Minh City University of Agriculture and Forestry, Ton Duc Thang University, Bach Mai Hospital, Da Nang University, Hanoi University of Mining and Geology, Duy Tan University.

In comparison to other countries, Vietnam placed 59th in rankings of international publications, after Thailand (the 43rd), Malaysia (the 38th), but higher than Indonesia (the 62nd) and Philippines (the 66th).

On a worldwide perspective, based on Thomson Reuters' Web of Science data for the 2010-2014 period, the United States contributed to almost 29% of international publications followed by China (nearly 11%), Britain (nearly 7%), Germany (6.6%), Japan (5%), France (4.5%), etc. In this stage, Vietnam only contributed 0.106% of the number of international publications [15].

Table 3. The numbers of international publications of some ASEAN countries extracted from Web of Science database (2011-2015)¹⁸

Number	Countries	Published number
1	Singapore	69.107
2	Malaysia	54.368
3	Thailand	39.226
4	Vietnam	11.953
5	Indonesia	10.679
6	Philippines	7.306
7	Cambodia	1.242
8	Laos	873
9	Brunei	681
10	Myanmar	461

Some measures to promote the development of S&T, education and training in Vietnam

The S&T strategy of Vietnam affirms strong S&T development as an integral part of the socialist-oriented market economy, which plays a key role in creating an environment to promote creation and innovation of technology, improvement of national S&T capacity for national socio-economic development.

The S&T implementation strategies of China, Korea, Japan, Thailand, etc., have left the following experiences [16]:

- Institutional reform for facilitation of S&T development: **building a national innovation system**, creating a healthy competitive environment among enterprises, setting up state management agencies to coordinate general policy and the national innovation system, etc.

- Implementation of some key solutions, policies like training human resources and attracting S&T talents, enacting financial and credit policies to facilitate technological innovation of enterprise sector, **making enterprises the main subject of technological innovation**.

- Increase in investment for S&T.

- Focusing on S&T international collaboration activities.

¹⁸ National Agency for Science and Technology (extracted and processed information from Web of Science database, March 31st, 2016. Figures for 2015 were preliminary data, the full statistics for 2015 have not been updated on Web of Science. Majors identified based on classification of Web of Science database).



In general, the solutions aforementioned have implications on policies to Vietnam for prioritization of certain groups of measures, *institutional reform* for S&T development aiming at linking research activities with application of research results in production and business.

In the S&T strategic planning of Vietnam, besides correct identification of the right priorities, it is essential to propose a mechanism for rapid formation *footrope subjects for technological innovation*. This is the *major force for implementation of S&T developmental strategy, linking S&T activities with business production within the framework of national innovation system*. Clearly, in the current context, it is necessary to promote and enhance the feasibility of S&T development strategies [16]. Additional review for revision and completion of a political system plays a cardinal part in promoting greater development of science and education in Vietnam in the context of international integration and globalization.

The emergence of "post-scientific society" will provide real opportunity for downstream countries like Vietnam. Reality has shown that *the ambiguous identification of philosophy for the education system in Vietnam nowadays constitutes a challenge a good opportunity for redesigning the Vietnamese education system*. It is possible to catch up with the characteristics and requirements of the new society in the context of international integration. Currently, science and education are considered "twin brothers" that need to be brought up together for consideration. In the context of the fourth technology revolution and the current knowledge economy, science must advance and play a pioneering role, leveraging the development of education. This becomes an opportunity for Vietnam to reconsider the role of investment in fundamental research and focus more on social sciences and humanities in its developmental strategy of S&T and education & training.

In such context, Vietnam needs to prioritize international collaboration in science and education (S&E), create a mechanism to apply international achievements in S&E in national science and economy in order to *successfully establish* some national world-class universities. Additionally, Vietnam also needs to closely link science with education; science and education with enterprises and the regional and international labor markets. This is an effort to enable the training "output" of Vietnam work in international environment without being inferior to anyone else. It is important to conduct structural organization of the system of scientific and educational institutions in order to enhance integration/collaboration of science and education, especially in training and research activities in universities. It is also crucial to come up with research results that directly serve the training purpose.

It is necessary to set new requirements for education in general and universities in particular with regards to training of S&T forces with creative and innovative thinking, the ones capable of connecting different ideas and integrating available scientific achievements, sensitive and creative in solving problems of developmental nature to meet the increasingly practical and diverse needs of people.

Currently, the number of Vietnamese intellectuals living and working overseas has reached over 300,000 people, including many world top professors, doctors, experts in some sectors of advanced science. It is necessary to strengthen and give autonomy and self-responsibility to educational and scientific institutions, thereby promoting the proactive role of these organizations in proposing and implementing special preferential regimes for Vietnamese intellectuals overseas with high qualifications, especially the elites.

The area has also witnessed the dominance of *higher education*. Most universities around the world are undertaking comprehensive reforms to become centers for training, scientific research, production, technology transfer and export of knowledge.



Therefore, the author argues that there should be a structural reform towards re-integration or restructuring into multidisciplinary universities (comprehensive universities under the old conception) at national or regional level. On the basis of restructuring the higher education system in the direction of reducing the number of universities to about two third of the current figure, the government should direct investment on establishment of some key universities at regional and international level.

In addition, continuous expansion of private and foreign invested schools is of similar importance. There should be appropriate policies to establish certain equality between schools (public and private ones) in the national education system. The government should issue specific, transparent and appropriate regulations on the rights and responsibilities of non-public organizations. Ministry of Education and Training shall manage and give directions to consolidate educational efforts and the nationwide system of degrees for all school categories, regardless of their nature, being public or private, national or local schools, etc. In the political and strategic system for S&E development and integration in Vietnam, the key problem lies in the method to master the trend of educational advocacy and development under the influence of S&T revolution and international transition as well as the current wave of regional and international integration in order to take full advantage of available chances, overcome challenges, strive to establish an *advanced, ethnic, creative, socialist-oriented S&E system in Vietnam worthy of equality, which meets all requirements to lead the future mission of industrialization, and modernization.*

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