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The Development of Scientific and Technologic Human Resource

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ABSTRACT: Scientific and technologic human resources are of great importance in producing innovations, amplifying knowledge of science and technology, are pivotal key to apply innovations in high technology – based production. In recent years, Vietnam concentrate in building science – technology human capacity to meet requirements of science and innovation - based economic growth. This paper aims to analyze results of Vietnam scientific and technologic human resources

KEYWORDS: human resource, scientific and technologic human resources, Vietnam

I. FACTS AND FIGURES OF SCIENTIFIC AND TECHNOLOGIC HUMAN RESOURCES IN VIETNAM

According to the report released by Ministry of Science and Technology, up to 2017, the science and technology staff is 172,683 people, from state – owned, private and foreign sectors, in which a state – owned component dominated 85.5% of the total number. About 75 - 80% of which are researchers, 6 – 8% are technicians, and 6 – 15% are tutors. Higher education staff accounts for the majority, up to 51.2% of the human resources and the researchers are of the highest number to 51%.

Table 1. Scientific and technologic human resources broken down by sectors and job titles

Unit: People

Economic sector	Total	Job tiltles		
		Researcher	Technicians	Tutors
Scientific and technologic human resources	**172,683**	**136,070**	**11,066**	**25,547**
R&D organization	34,197	26,681	2,406	5,110
Higher education	88,481	69,095	2,981	16,405
Science – technology service institution	3,229	2,331	442	456
Administrative office	20,584	14,949	3,148	2,487
Enterprise	26,192	23,014	2,089	1,089

Source: Ministry of Science and Technology, 2018

As it can be seen from table 1, researcher are dominant of higher education institutions and R&D organizations (research institutions and research centers…). The reports also states that 84,733 staff out of 172,683 are full – time employees, accounts for 49.1%; full – time researchers are 25%; 36.7%; and 70% at higher education institutions, administrative offices and enterprises, respectively.

There are 15874 who acquired Doctorate degree, of those 10,619 candidates are working at the higher education system, and the number of Doctorate – owned staff ranks the second and third in R&D organizations and administrative office. On average of 10,000 Vietnamese people, the number people who were honored the title of Professors are relatively moderate, are 1/8 and 1/3 in comparison to those of Chinese and German.

Researcher broken down by degree and sectors

Unit: people

Economic sector	Total	Degree			
		Doctorate	Master	University degree	College degree
Scientific and technologic human resources	***136,070***	***15,874***	***55,890***	***57,022***	***7,284***
R&D organization	26,681	4,029	9,261	12,694	697
Higher education	69,095	10,619	40,011	17,624	841
Science – technology service institution	2,331	122	607	1,509	93
Administrative office	14,949	865	4,718	8,069	1,297
Enterprise	23,014	239	1,293	17,126	4,356

Source: Ministry of Science and Technology, 2018

Full – time employees occupy to 50%, of which higher education and research institutions are of the highest numbers.

On the other hand, there are several challenges for researchers at R&D and higher education institutions. The prevalent trend may arise when several of senior researchers move from low – paid jobs to the lucrative and promising ones while new recruitments are fresh graduates without experiences. Other obstacle is that researcher ages are relatively high. Result from survey produced by the Ministry of Science and Technology, most of researchers who own Professor, Associate Professor Titles are equal and more than 60 years old; the number of those whose ages under 50 years old made up only 12%. 30% of more than 10,000 Doctorate employees are qualified to meet foreign language proficiency requirement to exchange ideas with international experts. In reality, most of local authorities are in serious shortage of researcher quantity and quality (more than 90% of science – technology organizations own more than 30 staff while the others own less than 10 people). Most of the researchers locate in Hanoi and Hochiminh city.

The reduction in higher – skilled and degree (Professor, Associate Professor, Science Doctor) staff are at an alarming level is driven by several causes: (1) the leading staff is retired; (2) low – paid and dead – end jobs that are unable to attract talents and young people; (3) the poor policy in human resource training, especially training syllabus; (4) the shortage of expenses on post graduates in the science and technology sector.

The monthly average salary for Senior – Professor lecturers is 11.4 million VND, excluded professional charges in comparison to 23.47 million VND; 102.8 million VND and 181 million VND of those in Japan, Korea and the United States, respectively. Other charges and remunerations are lower than those in the above – mentioned job title in the four countries. In other words, Vietnamese researchers salary is 1/16; 1/9; ½ of those who are in the United States, Korea, Japan, excluded other charges and remuneration[1].

It could not be doubt that, low – paid salary is blamed for brain drain in science and technology sector and researchers are unable to contribute to science and technology development in Vietnam. Other 100% state – supported budget organizations are unable to attract staff with good degree than the outstanding ones, because of the state – control and low – paid salary and remunerations than those of multinational, joint – venture companies and international organization, characterized by pay – for - performance mechanism.

The science technology and technology fields have the largest number of researchers, accounting for 34% of the total number of researchers, followed by the social sciences field with 27%. Medical science, pharmaceutical and natural science field have rates of 12% and 11% respectively which can be explained through incentives in Government policy to priority sectors and business sector. So that, R&D activities mainly focus on the field of science technology and technology.

II. THE QUALITY OF SCIENCE AND TECHNOLOGY HUMAN RESOURCES IN VIET NAM

Science & technology human resources play an increasingly important role in the country's socio-economic development. According to a study by the World Intellectual Property Organization (WIPO), the Knowledge and Technology indicator group in the Global Innovation Index (GII) in 2019 delivered a ranking of Scientific results, Vietnam ranked 37/129 countries and territories with 33.9 points. Especially, the Knowledge impact indicator is rated at the top.

Compared with other Southeast Asian countries, in terms of the Knowledge and technology indicators, Vietnam is ranked just after Singapore (11/129); Philippines ranked 31st; Malaysia ranked 34th; Thailand ranked 38th... As can be seen, Vietnam has a postitive change on the international ranking of technology and knowledge. However, this change has yet brought Vietnam to the strong assessment of this group of indicators. Countries that are rated as strong in the group of indicators on Knowledge and technology include: Switzerland, Sweden, Netherlands, Ireland, Czech Republic and Hungary.

In the statistics of Web of Science, in the period 2011 - 2016, among 6 ASEAN countries that have articles published in ISI magazine, it was captured that the number of articles of Vietnam is higher than the number of Indonesia and Philippines. From 2015 to 2016, this gap between Vietnam and Indonesia is narrowing and the same to the gap with Thailand, especially, the gap with Singapore is getting bigger. In 2016, the number of articles of Vietnam was only 1/4 of Singapore; 1/3

[1] https://jobs.sciencecareers.org/ *and https://www.work.go.kr/*

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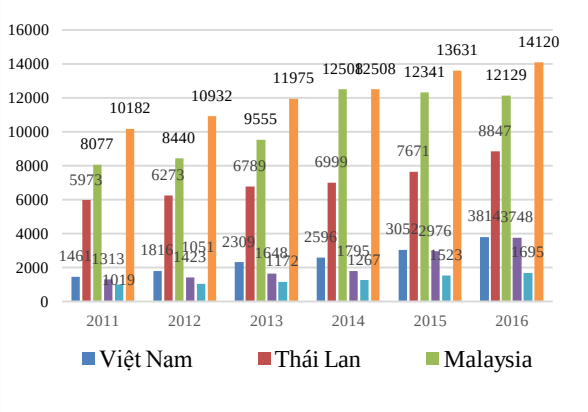
of Malaysia and ½ of Thailand. Meanwhile, Vietnam's population is 17 times that of Singapore, 3 times more than Malaysia and nearly 1.5 times that of Thailand.

Number of articles originating from Vietnam and some Southeast Asian countries published in ISI from 2011 to 2016



Scientific productivity - the number of articles published in Vietnam is increasing year by year and there are signs of stronger growth after 2017. The annual number of international publications in Vietnam has reached nearly 10,000 articles/year (2018), in which higher education institutions contribute up to 70%. The annual growth rate of WoS & Scopus articles in Vietnam has increased sharply (34.7% for the whole country and 41.6% for higher education institutions)

Number of articles in Vietnam and higher education institutions in Vietnam from 2014 to 2018

Năm	WoS			Scopus			WoS & Scopus		
	VN	ĐH	Tỉ lệ	VN	ĐH	Tỉ lệ	VN	ĐH	Tỉ lệ
2014	2799	1504	53,7%	4040	2749	68,0%	4332	2892	66,8%
2015	3453	1908	55,3%	4553	3077	67,5%	5003	3289	65,7%
2016	4366	2566	58,8%	5885	4156	70,6%	6461	4445	68,8%
2017	5129	3250	63,4%	6612	4862	73,5%	7217	5182	71,8%
2018	6691	4500	67,3%	8842	6858	77,6%	9719	7336	75,5%
Tổng	22.438	13.728	61.3%	29.932	21.702	72,5%	32.732	23.144	70,7%

In the period 2014 - 2018, the entire country published 22,438 WoS articles, 29,932 Scopus articles and a total of 32,732 articles in WoS & Scopus integrated database. At the same time, the corresponding figures of higher education institutions are 13,728 (WoS), 21,702 (Scopus) and 23,144 articles (WoS & Scopus), accounting for an average of about 70% of the national productivity.

The total number of Scopus articles is 1.33 times higher than the number of WoS articles; the total number of WoS & Scopus articles is 1.46 times greater than the number of WoS articles and 1.09 times higher than the number of Scopus articles. However, the total number of WoS & Scopus articles in the period 2014-2018 of Vietnam is equivalent to the published productivity of Indonesian Scopus articles in 2017 (21,300 articles) or in 2018 (33,988 articles).

In the period 2014-2017, on average, the number of WoS & Scopus articles rose by about 18.8% (from 4,332 articles to 7,217 articles in 3 years) each year. However, in just one year from 2017 to 2018, the number of articles increased to 34.7% (from 7,217 to 9,719 articles). Therefore, in 2018, Vietnam has almost reached the milestone of 10,000 international publications a year.

This result is slightly higher than the annual output of Scopus papers (eg 8,800 articles in 2018) of the National University of Singapore. Among them, the increase rate of publications in the two phases of WoS is 22.4% and 30.5%; of Scopus is 18.1% and 33.7%.

Similarly, the number of WoS & Scopus articles of Vietnamese higher education institutions increased by 21.8% on average each year, from 2014 to 2017. However, only from 2017 to 2018, this number jumped to 41.6%. In which, the rate of increase in the number of publications in the two phases of WoS is 29.4% and 38.5%; for Scopus is 21.3% and 41.1%.

In 5 years (2006-2010), there were only 200 patents and utility solutions granted in the National Office of Intellectual Property; only 5 patents were registered in the US. In 2011, Vietnam did not have any patents registered in the US, while Singapore had 647 degrees, Malaysia had 161, Thailand had 53, and Philippines had 27.

According to a report by the National Office of Intellectual Property, the number of patents granted for the period 2008 - 2018, the number of patents from foreign applicants is from 10-16 times. In the period of 2017-2018, the number of Vietnamese applicants has increased from 76 degrees (in 2016) to 205 degrees (in 2018). However, the number of foreigner's degrees also increased from 1247 (in 2016) to 2014 degrees (in 2018). As can be seen, the number of patents granted by Vietnamese application owners is very small compared to foreign application owners.

III. CONCLUSION

In general, the increase in quantity and improvement in the quality of S&T human resources have contributed significantly to the socio-economic development of Vietnam recently. However, Vietnam currently lacks a lot of science

and technology researchers to reach the rate of 10-12 scientific staff per 10,000 people by 2020; S&T human resource structure is unevenly distributed, lacking in quantity and weak in quality; the connection between S&T public institutions with the business sector and the training sector is not yet tight, which leads to a waste of resources investing in S&T (research results have not yet been applied in practice). In many places, both direct and indirect human resources in S&T public institutions are inadequate and inadequate in structure; has not confirmed the professional capacity, research capacity; has not really become an effective tool to promote socio-economic development.

Lack of excellent scientists and leading scientists: although the number of S&T staffs with doctorate and master degrees is quite large, the shortage of contiguous contingents is happening at present. The number of scientists with high qualifications and experience is decreasing due to the retirement age, especially in the priority S&T fields, the high-tech fields. In addition, the phenomenon of "brain drain" has been going on for many years, the growing market economy has led numerous employees with deep expertise moving to work for private enterprises sector or foreign-invested enterprises with higher income levels. A large number of people who completing their overseas master's and doctoral training programs, have not returned to their home country to work. Accordingly, there is a serious shortage of talented scientists in research institutes and universities, especially the lack of leading scientists and general constructors capable of leading important S&T tasks on national and international scale.

The spirit of research cooperation and teamwork skills of S&T human resources remains weak: another limitation of the Vietnamese S&T workforce is that cooperation and cohesion between scientists is not high, difficult to form strong research groups, strong interdisciplinary research groups operating in a long-term and sustainable orientation.

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