

## **Commercialization of Scientific Research Activity Results at Vietnam's Universities: Current Challenges and Solutions**

Quoc Cuong Nguyen<sup>1,2,#</sup> and Hoang Tuan Nguyen<sup>2</sup>

<sup>1</sup>*Assistant Professor, Faculty of Technology, Dong Nai Technology University, Dong Nai, Vietnam*

<sup>2</sup>*Dong Nai Institute for Innovation, Dong Nai, Vietnam*

*E-mail [nguyenquoccuong@dentu.edu.vn](mailto:nguyenquoccuong@dentu.edu.vn)*

### **Abstract**

*Commercialization of research results plays an important role in the socio-economic development of a country based on science, technology and innovation. However, in recent years, the commercialization of research results by universities in Vietnam remains ineffective because scientists often carry out research on issues they find interesting, and don't listen to enterprises to find out what the latter need. In the other hand, the process of commercializing research results in universities encounters difficulties, including the issue of establishing intellectual property rights the limited quality of research results, and the limited access to capital resources to develop inventions. This paper focuses on analyzing the current challenges of commercialization of research results in universities and propose solutions to promote commercialization of research results from the universities, suitable to the conditions of Vietnam.*

**Keywords:** *Research Results, Technical Solutions, Scientific, Commercialization.*

### **1. Introduction**

Nowadays, scientific and technical potential is the most obvious index of development in a country. Increased capacity and scientific and technical efficiency and optimal use of it require detailed understanding of its components. These components include a set of human resources, financial and capital resources, equipment and physical space which are applied under an organized coherent management in the field of science and technology.

Commercialization is a complex process, going through various stages from conceptualization to successful marketing [1]. Commercialization of scientific research results and technological development is a process from which a research idea or research product is introduced to the market. This is a multi-step process to help transform an idea into a commercial able product and generate revenue from royalties or sales (also known as commercial exploitation of intellectual property) [2]. Commercialization of research results is a process of bringing research results into products to market, accepted by the market. This process is associated with research and development and technology transfer activities; and requires the alignment and close cooperation among the government, industries, businesses, investors, financial institutions, universities to turn research

---

Manuscript Received: May. 2, 2023 / Revised: May. 7, 2023 / Accepted: May. 10, 2023

Corresponding Author: [nguyenquoccuong@dentu.edu.vn](mailto:nguyenquoccuong@dentu.edu.vn)

Tel: +84-909-449 554, Fax: +84 -2513-996 915

Assistant Professor, Faculty of Technology, Dong Nai Technology University, Vietnam

results into valuable products, especially economic value. In recent years, at the universities of Vietnam, research results are often associated with the results of the projects and most of them are state funded projects and Vietnam posts thousands of inventions and research results from the academic and corporate world, as well as from individuals and private groups.

According to National Agency of Science and Technology Information, research results include inventions, patents, technical solutions, technical know-how, business secrets, layout designs of semiconductor integrated circuits, industrial designs, trademarks, trade names, seedlings, computer programs, technical designs, scientific works and other subjects, including protected subjects and are not protected under the provisions of intellectual property law [3]. The process of commercialization of research has many different forms. Specifically, at present, there exist four main organizational models for commercializing research results in the world, including: (i) technology transfer centers; (ii) business incubator; (iii) affiliated company/subsidiary representing technology transfer; (iv) holding company (parent company) [4]. Depending on the characteristics of each country and each university, these 4 models may or may not be fully present in each university. In general, organizations that commercialize research results (according to the four models above) perform the functions of commercializing research results such as: a bridge between the industry-university sector and the government; support financial resources, service provision, human resources and infrastructure to promote the university's research; support the establishment of spin-off companies in the university; support the establishment of start-ups; generate revenue for the university and support local economic development.

For example: In the United States, the results of research some universities are transferred and commercialized through Technology transfer offices (TTO) or technology licensing offices (TLO). The offices are located at universities or in production areas of the United States [5]. For universities and research institutions in the field of agriculture, through TLO network are located in the agricultural extension center in the key production areas of the states. These organizations join from the initial steps of commercialization process, right after the researchers and universities announced their research results [6].

There are many research works related to commercialization of scientific research results in Vietnam. N.Q. Tuan proposed state policy to promote the commercialization of results of scientific research and technological development using state budget [7]. H.N. Luat, et al addressed the solutions for commercialization scientific result from university to enterprise [8]. N.H. Xuyen, et al proposed solutions to promote the commercialization of research results and patents to serve technological innovation of enterprise from universities of Vietnamese [9,10]. However, these studies have not clarified the current challenges for the commercialization of scientific research results from the perspective of scientists, who are in charge of scientific research projects. This paper focuses on analyzing the current challenges of commercialization of research results in universities and propose solutions to promote commercialization of research results from the universities, suitable to the conditions of Vietnam in the age of industry 4.0.

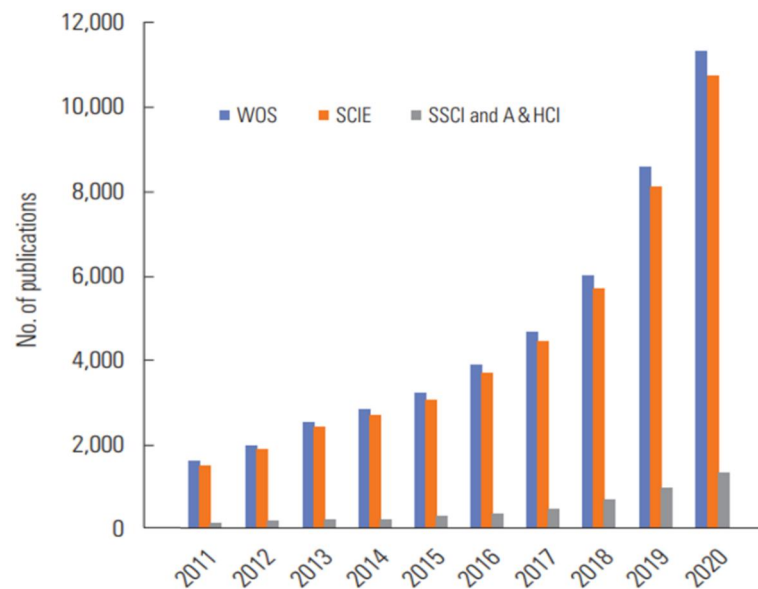
## **2. Materials and Methods**

This paper use qualitative research methods, collects data from reports from the National Agency for Scientific and Technological Information, National Office of Intellectual Property of Vietnam, Departments of Science and Technology of provinces and cities. In addition, it is also combined with interviews with questionnaires of 120 lecturers, experts and scientists who are working at universities, research institutes, scientific and technological organizations in Vietnam.

## **3. Current Challenges of research activities, commercialization of research results from Vietnam's universities**

### 3.1 Regarding to Intellectual Property

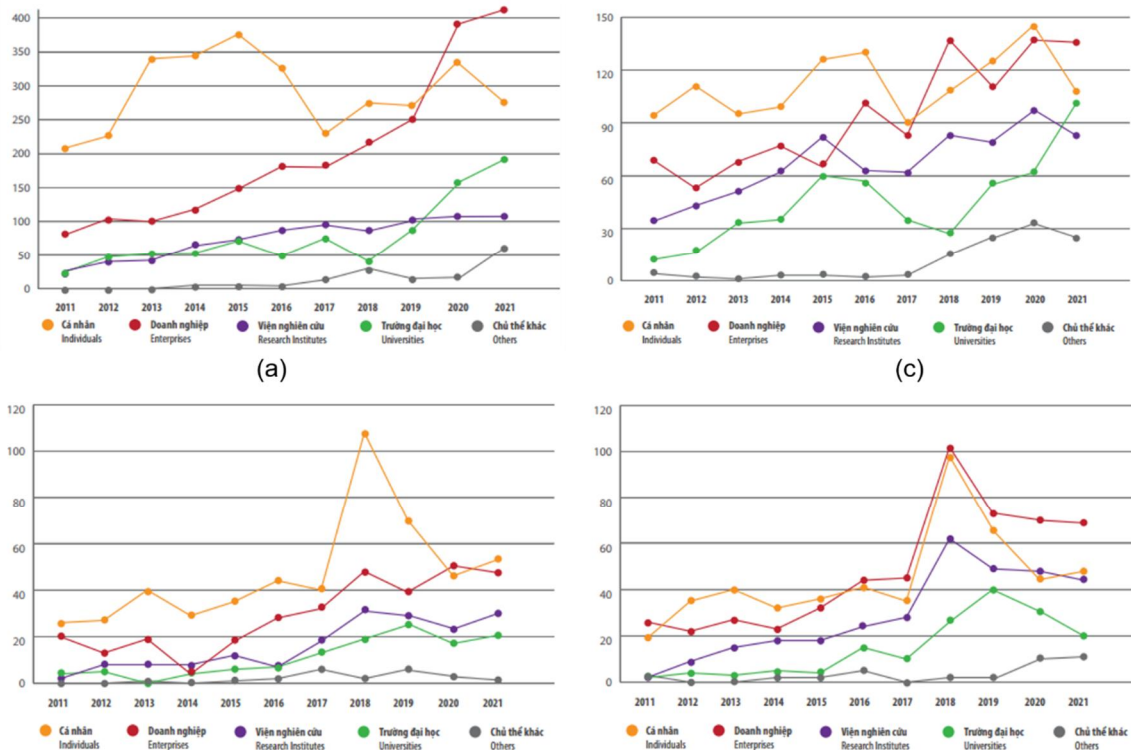
Vietnam has about 237 universities, 16,500 doctorates, 574 professors and 4,113 associate professors. Annually training about 1,500 doctorates, 36,000 masters, nearly 1.5 million university students and several thousand scientific research projects at all levels deployed from universities [11]. According National Agency for Science and Technology Information, Vietnam currently has built database of research results, containing digitized summary and full text, published on the Vista network. In particular, national leveled researches accounts for approximately 30%, ministerial with 34%, provincial with 31%, and university level with 5%. In particular, national leveled researches accounts for approximately 30%, ministerial with 34%, provincial with 31%, and university level with 5%. According to the WoS database[12], the number of Vietnamese articles published in international science and technology journals in the period 2010 - 2020 has increased by 5 times, from about 2000 articles to over about 10000 articles as show in Fig.1. In terms of the average annual growth rate, the number of international publications increased by an average of 2% per year in the period 2010 - 2020, especially in the last 2 years, with the average growth rate in 2020 increasing by 40 % compared to 2019. Most of the research results are concentrated in institutes, universities or science and technology organizations.



**Figure 1. International publications from Vietnam from 2000 to 2020. WOS, Web of Science; SCIE, Science Citation Index Expanded; SSCI, Social Sciences Citation Index; A & HCI, Arts & Humanities Citation Index. (source: authors synthesized from Web of Science [12]).**

In the other hand, according to the statistics of the Intellectual Property Office of Vietnam [13], Ministry of Science and Technology, in the period from 2011 to 2021, the average number of invention registration from Vietnamese universities gradually increase from 25 to 190, and from research institutes increase from 25 to 110 (Fi.g 2.(a)) while number of patents granted for invention from Vietnamese universities only increased from 3 to 20 and from research institutes only increased from 3 to 30 (Fig. 2(b)). Similarly, in the period from 2011 to 2021, the average number of utility solutions from Vietnamese universities gradually increase from 15 to 110, and from research institutes increase from 35 to 80 (Fi.g 2.(c)) while number of patents granted for utility solutions from Vietnamese universities only increased from 2 to 20 and from research institutes only

increased from 2 to 45 (Fig. 2(d)). Thus, in nearly ten years, the number of patent applications of Vietnamese people has not increased much, maintaining in about 10% of the total applications for patent protection in Vietnam. The proportion of patents granted to Vietnamese people is still low, the highest is in 2017 and 2018, which is only 6.2% of the total granted patents. Although the number of applications and protection certificates granted to inventions is not much, the number of applications from universities and research institute in Vietnam has been negligible over the years. This results show that universities are not really interested in protecting intellectual property.



**Figure 2. (a) Number of Vietnamese invention applications; (b) number of patents granted for invention and (c) number of utility solution applications; (d) number of patents granted for utility solution by holder from 2011 to 2021 (source: [13])**

3.2. Regarding to Technology transfer

Although the number of research topics, research works published in international journals is very large. However, according to the annual reports of the National Office of Intellectual Property (2011-2021) [13], the number of useful solutions, the patents contracted from the universities and research institute for technology transfer are very few (Fig. 3). The above data shows that, although universities and research institutes are an extremely rich and potential source of intellectual property, scientific research results show that this "resource" has not yet given results commensurate with the available intellectual human resources. Therefore, it can be affirmed that the research activities of universities are not highly effective, the quality of research results and inventions granted is still limited as well as technology transfer activities commercialization of scientific research findings from universities to enterprises are weak, ineffective and very limited compared to the abundant potential of universities and institute. Most of them only solve the single problems that arise in the production process, many patents do not serve commercialization objectives that are primarily to meet the requirements of orders from funding agencies and projects. Moreover, universities are not really interested in

commercialization of research results, including commercialization of patents.

Năm / Year	Số lượng đơn đăng ký hợp đồng chuyển giao quyền sử dụng theo đối tượng SHCN Number of requests for registration of licensing contracts by subject matters				Số lượng hợp đồng chuyển giao quyền sử dụng theo đối tượng đã được đăng ký Number of registered licensing contracts by subject matters			
	Các đối tượng / subject matters				Các đối tượng / subject matters			
	SC/GPHI Invention/ utility solution	KDCN Industrial design	NH Trademark	Tổng số Total	SC/GPHI Invention/ utility solution	KDCN Industrial design	NH Trademark	Tổng số Total
2011	5 (5)	0	165 (495)	170 (500)	4 (4)	1 (2)	138 (504)	143 (510)
2012	1 (1)	1 (1)	210 (775)	212 (777)	1 (1)	1 (1)	139 (573)	142 (575)
2013	8 (28)	1 (1)	195 (608)	204 (637)	4 (4)	1 (1)	159 (336)	164 (341)
2014	2 (4)	3 (4)	201 (808)	206 (816)	5 (18)	1 (1)	210 (796)	216 (815)
2015	1 (1)	5 (14)	249 (1414)	255 (1429)	3 (8)	6 (27)	194 (934)	203 (969)
2016	10 (13)	16 (16)	189 (616)	215 (645)	6 (6)	18 (18)	201 (1033)	225 (1057)
2017	3 (3)	2 (2)	234 (605)	239 (610)	3 (6)	0	175 (581)	178 (587)
2018	3 (3)	2 (11)	216 (399)	221 (413)	5 (5)	3 (3)	231 (522)	239 (530)
2019	7 (11)	4 (15)	187 (391)	198 (417)	3 (4)	1 (2)	224 (384)	228 (390)
2020	8 (16)	1 (1)	128 (420)	137 (437)	8 (13)	3 (13)	137 (355)	148 (381)
2021	5 (6)	3 (4)	82 (199)	90 (209)	8 (14)	2 (2)	117 (386)	127 (402)

**Figure 3. Licensing contracts by subject matters (figures in blanket are the numbers of licensed subject matters)**

### 3.3 Linkage between universities and enterprises, with intermediaries in science and technology

Many scientist and experts are of the opinion that state investment in science only caters for research and development (R&D), but does not go so far as to take these innovations to their final stages where they become applicable products. Vietnamese scientists currently lack the support framework to complete new technologies, and crucially, they also lack information on the demand of enterprises. In addition, the intermediary organization is not strong enough to provide connection services, support supply side, demand side and other parties in transactions related to technology and intellectual property. Technology exchanges are not really efficient.

## 4. Solutions for Promoting Commercialization of Research Results in Vietnam's Universities

From the above challenges, some solutions to promote the commercialization of research results in universities could be offered as follows:

### 4.1 Protection mechanism for intellectual property

The legal system for protecting intellectual property rights needs to be tight to help researchers protect their intellectual property. Regulations on the protection of intellectual property rights should also be considered and improved, ensuring maximum protection for research results of scientists, giving scientists peace of mind in research and application into real life, the most effective is to commercialize research results. It is necessary to support universities to establish intellectual property rights, support evaluation and evaluation

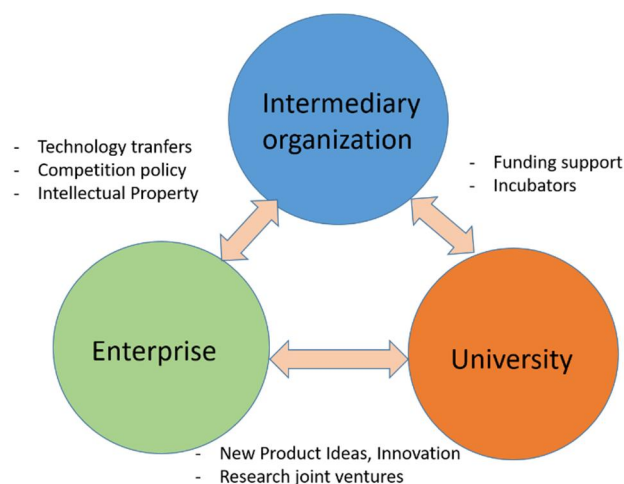
of research results; support the order and procedures for the transfer of ownership and use of scientific research and technological development results using the state budget. Along with that is to support universities to establish intellectual property networks to advise scientists to determine whether their research results can register for patents, technical solutions and good commercialization.

#### 4.2 Improving the quality of scientific research activities

The universities need combine the research activities with production and business practices of enterprises in the direction of enhancing research activities towards applications and goods from enterprises. In order to do well, it is necessary to nurture, maintain and encourage the development of strong organizations for scientific research and technology deployment. Furthermore, it is necessary to increase investment in material and technical foundations, equipment and laboratories, creating favorable conditions for research groups to strongly form and develop ideas towards social needs.

#### 4.3 Application of the triple helix model for commercialization of research results

It is necessary strengthen the link between universities and businesses and stakeholders in the process of commercializing research results. The parties need to clearly identify the motivation, goals and associated policies. In which, clearly defined tasks, powers, responsibilities of parties in joint activities, especially coordination mechanism in commercialization of research results (Fig.4). On that basis, develop mechanisms of sharing benefits in the link, pointing out the relationship between the benefits of linking the three forms of association Basic: businesses and universities and intermediary organization, the same effects benefit and bear the same risk; enterprises (as researchers using research results) order for university research universities; businesses and universities link by value chain, jointly research and commercialize research results. Intermediary organization implements incubators and funding support for the university. Especially, focusing on developing intermediary organizations that play a focal role in the network, capable of providing services to support the trade of scientific research results; intermediaries at research institutes, higher education institutions, especially at national universities, regional universities, and key universities.



**Figure 4. The triple helix model for commercialization of research results**

#### 4.4 Developing spin-off enterprise and start-up enterprise

In order to implement commercialization of research results, the establishment of technology businesses to commercialize these results is indispensable. Technology transfer to technology corporations is a form of permission to conduct research, but this often requires the researcher's "sale" of intellectual property. Establishing start-ups owned by scientists with their own research institutions is a way to both allow the

commercialization of technology and allow scientists to gain long-term benefits from owning assets. their intelligence, and also the research agency itself thus reaps economic benefits. This is the model of spin-off companies (university spin-off companies or technology spin-off companies), which is very popular in developed countries. In Vietnam, applying the solutions to develop spin-off businesses are also a method to promote the commercialization of research results in universities [14]. Furthermore, recently Vietnam's innovation startup ecosystem is thriving thanks to the expanding scale of the national economy. Therefore, applying the solutions to develop start-up enterprise are also a method to promote the commercialization of research results and technology transfer activities in universities [15,16].

## 5. Conclusion

In order to implement the research results, the establishment of technology businesses to commercialize these results is indispensable. Universities are the main source of technology, intellectual property, research results, experimental products, and inventions. The proposed solutions can be applied to technology transfer, commercialization of scientific research results, in order to contribute to improving production capacity, product quality, and product competitiveness of enterprises. industry, contributing to socio-economic growth in the age of industry 4.0.

## Acknowledgement

This work was supported by Dong Nai Technology University Research Fund in 2022.

## References

- [1] J. Goyal and J. Menke, "New technology profitably and quickly", *Oracle Corporation*, 2006.
- [2] J. Kelly, M. Cosijin, M. N. Nguyen, R. Hays, H. C. Nguyen, H. X. Nguyen, C. Johns and D. N. Pham, "Commercialization Guide Plus", *CSIRO and Ministry of Science and Technology*, 2021.
- [3] National Agency of Science and Technology Information, "Knowledge transfer and commercialization of public research results: New trends and policies", *Scientific Review*, 03, 2014 (in Vietnamese).
- [4] H. K. Tuoc, "Research and develop a model for commercializing research results in universities and propose mechanisms and policies", *Ho Chi Minh Department of Science and Technology Project Report*, 2020.
- [5] A. J. Stevens, "The enactment of Bayh-Dole", *Journal of Technology Transfer*, Vol.29, Issue.1, pp. 93–99, 2004. DOI <https://doi.org/10.1023/B:JOTT.0000011183.40867.52>
- [6] Ng. T. P. Lan, "Commercialization of research products of the university: The secret of success of the United States", *The journal Tia Sang*, 2017. (in Vietnamese).
- [7] N. Q. Tuan, "State policy to promote the commercialization of results of scientific research and technological development using state budget", *Science and Technology Policy and Management Journal*, No. 2, 2013 (in Vietnamese).
- [8] H. N. Luat and N. T. N. Kha, "Commercialization scientific result from university to enterprise: current status and solution", *Journal of Science and Technology Policy Management*, No.1, 2015 (in Vietnamese).
- [9] N. H. Xuyen, T. L. Huong and N. T. L. Huong, "Commercialization of research results in Vietnam's universities to serve the enterprise's Innovation", *International Journal of Business, Economics and Law*, Vol. 21, Issue 5, pp.20-24, 2020.
- [10] N. H. Xuyen, T. L. Huong and N. T. L. Huong, "Solutions to Promote Commercialization of Research Results in Vietnamese Universities", *Journal of Business and Economic Development*, Volume 5, Issue 2, pp. 82-89, 2020. DOI <http://doi:10.11648/j.jbed.20200502.14>
- [11] National Agency of Science and Technology Information, "Investigation of innovation in Vietnamese enterprises", *Science and Technology Publishing House* (in Vietnamese), 2018.

- [12] Clarivate Analytics, “Web of Science: the world’s largest publisher-neutral citation index and research intelligence platform”, *London: Clarivate Analytics*, May, 2021.
- [13] Intellectual Property office of Vietnam, Ministry of Science and Technology, “Intellectual Property Activities Annual report”, 2021.
- [14] Q. C. Nguyen, T. H. Tran and H. D. Kwon, “Study on Spin-off Business Model for the Exploitation of Intellectual Property at University in Vietnam.” *International Journal of Advanced Smart Convergence*, Vol. 11, no. 1, pp. 48-54, 2022. DOI: <https://doi:10.7236/IJASC.2022.11.1.48>.
- [15] Q. C. Nguyen, T. H. Tran and H. D. Kwon, “Development of Startup Ecosystem in Vietnam in the Context of the Fourth Industrial Revolution.” *International Journal of Advanced Smart Convergence*, vol. 9, no. 2, pp. 76–83, 2020. DOI: <https://doi.org/10.7236/IJASC.2020.9.2.76>
- [16] Q. C. Nguyen, T. H. Tran, Q. K. Nguyen and H. D. Kwon, “Current Status and Solutions for Promoting Innovative Startup in Vietnam” *International Journal of Advanced Smart Convergence*, vol. 10, no. 3, pp. 97–104, 2021. <https://doi.org/10.7236/IJASC.2021.10.3.97>