

COMMERCIALIZATION OF RESEARCH RESULTS IN VIETNAM'S UNIVERSITIES TO SERVE THE ENTERPRISE'S INNOVATION

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ABSTRACT

Commercialization of research results plays an important role in the socio-economic development based on science, technology, especially for research results that are inventions in the field of Internet of Things (IoT), serving the technological innovation roadmap of enterprises. In Vietnam, promoting the commercialization of research results in universities to serve enterprise's innovation activities is encouraged by the Government. However, the number of commercialization results from universities is still limited; transaction value is not high. This paper focuses on analyzing research results at Vietnam's universities, then proposing solutions to promote the commercialization of research results and patents related to IoT applications to serve technological innovation of enterprise from universities of Vietnamese.

Keywords: Innovation and commercialization of research result.

INTRODUCTION

Commercializing research results is the process of discovering knowledge, developing such knowledge into technology and transforming technology into products, or processes (McCoy, 2007) and introducing to the market to economic value creation (Isabell, 2004). Commercialization is a complex process, going through various stages from conceptualization to successful marketing (Goyal, 2006). In Vietnam, the term research results commercialization is interpreted as commercialization of scientific research results, or commercialization of scientific and technological research results, or commercialization of scientific research and technology development results. In recent years, at the universities of Vietnam, research results are often associated with the results of the projects, and most of them are invested by state funding. According to the Vietnam Ministry of Science and Technology (2014), research results include inventions, utility solutions, technical know-how, business secrets, innovations, 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. The research results are determined on the basis of a contract to perform the tasks of science and technology. The State supports can be through providing funds or licensing the right to use state-owned facilities, instruments and techniques to perform scientific and technological tasks.

Research results may appear in the form of invention or non-invention. An invention is a technical solution in the form of a product or a process to solve a specific problem by applying natural laws. The invention is protected in the form of patenting if it meets conditions such as newness, creativity, and industrial applicability. The invention is protected in the form of granting a patent for a utility solution if it is not a common understanding and meets conditions such as newness and industrial applicability (Intellectual Property Law, 2009). Non-inventions include publications (articles, books, training materials, etc); research cooperation; sharing equipment and information; consulting and training; forming startups, etc.

At the university, the research results are the product of intellectual activity, as assets and goods, should be traded with expectations firstly bring value to the university and the scientists, thus creating the spread radiating for society and promoting economic development. Commodities in the form of research results often exist in the form of information, knowledge, patterns, so it is difficult to identify by human senses but can only perceive through the process of self-awareness, transmission, exploitation and commercialization. Due to the nature of research results that are profitable, they can be exchanged, traded, transferred, contributed, leased in the market and follow the law of supply and demand.

At the level of organization, the industry-university office of the University of British Columbia has developed measurement methods, which also include the non-traditional effects of license activities, along with assessing the impact of licensing to measure and directly assess aspects related to the commercialization and knowledge transfers. Key indicators of knowledge transfer and commercialization in universities include: Indicators of investment and cooperation between universities/research areas and industry; Indicators of the potential for commercialization of knowledge, focusing on the published information store; Indicators on the use of public knowledge of enterprises and other institutions; Indicators of other knowledge transfer channels, such as skilled labor migration and network setup (Box 1).

Box 1 : The indicators of commercialization and knowledge transfer in universities:

1. Indicators of investment and cooperation between universities/research areas and industry:
 - Index of research and development funded by enterprises for higher education.
 - Knowledge source for innovation based on the type formed from universities
 - The number of cooperations of innovation among enterprises and higher education institutions and state - owned research organizations
 - Co-author between industrialist and researcher in university / research institutions
2. Indicators of the potential for commercialization of knowledge, focusing on the published information store:
 - Announced patent (patent registration forms).
 - Number of patents of enterprises.
 - Number of patents of research organizations, includes universities.
3. Indicators on the use of public knowledge of enterprises and other institutions:
 - The proportion of university patents and patents resulted from the cooperation between universities and outside but still counts as patents of universities;
 - Income from license;
 - Creating businesses originated from research results and inventions
4. Indicators of other knowledge transfer channels, such as skilled labor migration and network setup:
 - The commercial activities of the academic sector.
 - The degree of interaction in the academic area.
 - Moving interdisciplinary S&T human resources;
 - The amount of PhD holders change in the last 10 years;
 - Cross-movement of authors with scientific publications.

Source: National Agency of Science and Technology Information (NASATI, 2014)

In Vietnam, most of findings formed through research funded by the state in the form of scientific tasks and technological development. Therefore, according to the current regulations, the ownership of these research results belongs to the state (if the state grants 70% or more of the total implementation budget), the university is the host and chairman, and the implementing members are the authors. Therefore, in the process of commercializing research results, it is necessary to comply with the benefit distribution between the parties (Law on Science and Technology in 2013, Law on Technology Transfer in 2017 and Decrees and Circulars explaining, guiding the implementation of some articles of the Law). Scientific and technological tasks using the state budget include scientific and technological tasks at national, ministerial, provincial and institutional/ university levels managed and controlled by competent agencies (Article 27 of the Law on Science and Technology, 2013). Scientific and technological tasks at the national, ministerial and provincial levels must comply with the order form. The ordered products are reflected through the contract, this is an important basis to conduct the evaluation and acceptance of ordered products after completing scientific and technological tasks.

RESEARCH RESULTS

The number of research results in universities

According Vietnam National Agency for Science and Technology Information (NASATI, 2018), Vietnam currently has database of research results, described overview and digitized full text, published on the Vista network. In particular, national leveled researchs accounts for approximately 30 %, ministerial with 34 %, provincial with 31 %, and university level with 5%. Most of the research results are concentrated in institutes / universities, science and technology organizations. It is estimated that every year about 1,400 research results are registered in the Department of Information Science and Technology, of which there are many tasks implemented 2-3 years. . The results of the study are the product of scientific activities and technological development of the mission of science and technology, including the synthesis report the results of implementation tasks, the report summarizes the results of performing the task service; annex summarizes survey data, surveys, maps, drawings, photos, multimedia documents; the software. They are registered and stored at the NASATI. The database currently has over 23,500 bibliographic and summary descriptions, updated from about 1200-1500 tasks per year. The tasks after acceptance must be registered at the NASATI..

Regarding the publication of domestic science and technology:

From Vietnam's science and technology databases, gathered with the publications of 236 science and technology magazines (accounting for 70% of the total number of domestic science and technology journals), Ministry of Science and Technology (2018) showed that, until 12/2017, Vietnam had a total of over 240,000 scientific articles, averagely each year about 19,000 articles, in 2017 reached 19,575 articles, in 2019 reached over 20,100 articles, the number of scientific articles published every year increased but not much (NASATI, 2019).

In the field of science and technology, Vietnam's scientific articles in 2017 focus mainly on social sciences and humanities, accounting for more than 70% of the total published scientific papers, science and technology accounted for 12.4%, the lowest was natural science with only 4.5%, medicine and agriculture science, each of which accounted for nearly 6%, with more than 830 articles. However, in the period 2018-2019, agricultural sciences had the lowest number of domestic publications, and natural sciences had a significant improvement (NASATI, 2019).

Regarding the international publication of science and technology:

According to Scopus database, the total international number of articles published in Vietnam in the period of 2014 - 2018 has increased sharply, from 4,071 articles in 2014 to 8,821 articles in 2018 (NASATI, 2019). In ASEAN, Vietnam ranked fifth in total international publication in the period from 2012 - 2017, but was only half of the countries ranked 4 (Indonesia), 1/3 of 3rd country (Thailand), and about 1/6 of the region's leading country (Malaysia).

Regarding patent registration and utility solutions:

The data on registration applications and the number of industrial property protection certificates shows certain levels of national innovation, research and development capacity. Table 1 shows that in 6,071 applications for patent protection in Vietnam, there are 646 applications of Vietnamese people (10.64%). 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 patent patents granted to Vietnamese people is still lower; the highest is 2017, which is only 6.2% of the total granted diplomas.

Table 1: Number of applications and protection titles granted to the invention

Year	Number of patent applications			Number of exclusive patents granted		
	Vietnamese	Foreigner	Total	Vietnamese	Foreigner	total
2011	301	3,387	3,688	40	945	985
2012	382	3,577	3,959	45	980	1,025
2013	443	3,726	4,169	59	1,203	1,262
2014	487	3,960	4,447	36	1,332	1,368
2015	583	4,450	5,033	63	1,325	1,388
2016	560	4,668	5,228	76	1,347	1,423
2017	592	4,790	5,382	109	1,636	1,745
2018	646	5,425	6,071	205	2,014	2,219

Source: National Intellectual Property Office (2019)

Although the number of applications and protection certificates granted to inventions is not much, the number of applications from universities in Vietnam has been negligible over the years. This shows that universities are not really interested in protecting intellectual property. On average in the period of 2007-2017, the number of patents granted to research institutes and universities of Vietnam was only about 100 patents /year.

For a useful solution, the number of Vietnamese applications is higher than that of foreigners. However, the increase in the number of applications over the years is negligible, even in 2018, compared to 2016 and 2017 (Table 2).

Table 2: Number of application and protection certificates granted for utility solutions

Year	Number of applications for registration of useful solutions submitted			Number of patents for useful solutions		
	Vietnamese	Foreigner	Total	Vietnamese	Foreigner	Total
2011	193	114	307	46	23	69
2012	198	100	298	59	28	87
2013	227	104	331	74	33	107
2014	246	127	373	66	20	86
2015	310	140	450	86	31	117
2016	326	152	478	114	24	138
2017	273	161	434	118	28	146
2018	370	187	557	290	65	355

Source: National Intellectual Property Office (2019)

Recognizing the potential market, many countries already have patent registration and utility solution applications in Vietnam. Especially Japan, USA, Korea and Germany.

The difficulties in commercialization research results at universities in Vietnam

Firstly, the linkage between the Vietnam's universities and enterprises still limited, especially in linking to commercialize research result for enterprise's innovation activities. According to the survey results of 7,641 Vietnam's enterprises (NASATI, 2018), it shows that commercialize and technology transfer methods from science and technology organizations (including universities) to enterprises for process innovation still very limited, only 0.9% of businesses choose. The cause of this phenomenon is that the research results of the universities are only sample products, stop at the laboratory scale so the risks high risks when businesses invest, and most of the research results are not really mounted with the needs, requirements of enterprises.

Secondly, the accepted research projects of Vietnamese universities are also less applicable (Nguyen Quang Tuan, 2013), survey results show that: only 10/107 topics have created solutions, inventions and transferred directly into production. However, there are 6/10 managers, the host agency reposed that they "don't remember", or does not indicate the application business address; In the 4 topics, it shows the application address, there are 2/4 admitted they were not successfully apply the results and the remaining 2 topics have not clearly defined economic efficiency when applied to production and business. Only 01/107 topics are commercialized in the form of a science and technology enterprise, but the research team has not yet evaluated the status of this enterprise.

Thirdly, activities to commercialize research findings in universities, which are products from the projects using the State budget, is limited, failing to meet the requirements of technological innovation and development goals economic and social development. Regulations on valuation of scientific research and technological and intellectual property development results using the state budget (Joint Circular No. 39/2014/TTLT-BKH-CN-BTC); regulations on the management and use of assets are formed through the implementation of scientific and technological tasks using state capital (Decree No. 70/2018 /ND-CP of the Government) have not yet created favorable conditions for commercialization of research results, not being implemented synchronously and scientifically.

In addition, currently, universities mainly focus on training, scientific research activities associated with production and business of enterprises are not paid high attention. According to the annual reports of the Department of Intellectual Property (2015-2018), there is only a few traded contracts, patent transfers, utility solutions was signed from the universities. This shows that universities are not really interested in commercialization of research results, including commercialization of inventions. Moreover, the quality of inventions granted to universities is not high, most inventions only solve the single problems that arise in the production process, many protected inventions do not serve commercialization objectives that are primarily to meet the requirements of orders from funding agencies and projects.

CONCLUSION

In order to commercialize research results in universities, especially for research results the field of IoT, serving the technological innovation of enterprises, it is necessary to look at the following points of view: The commercialization of research results in universities must come from the needs of enterprises, being enterprise-centered to orient research activities; Application of research results is a criterion to evaluate universities, which is the basis for the State to fund annual research activities, especially public universities.

Thus, in order to promote the commercialization of research results in universities, needing some solutions as follows:

Firstly, support the link between universities and enterprises in the process of commercializing research results. There are several main forms of linking: enterprise and university to collaborate on research, mutual benefits and risk as agreed; the enterprise orders for university for research on the basis of its needs; enterprise and university linked by the value chain method, jointly researching and commercializing research results. In order to ensure successful links, university and enterprise need to clearly identify related goals and policies. It clearly defines the tasks, powers and responsibilities of the parties in the common activities, especially the mechanism of coordination and benefit sharing in the commercialization of research results.

Secondly, strengthen confidence of enterprise in applying research findings from the university. Thus, need to improve the quality of research activities of universities, combining between research activities with production activities of enterprise. In order to do well, it is necessary to nurture, encourage the development of excellent organizations for scientific and technology research. Along with that, to increase investment in material and technical foundations, laboratories, creating favorable conditions for university's excellent organization developing ideas towards social needs.

Thirdly, supporting the formation of commercialization and technology transfer units in universities to support evaluation of research results; support procedures for the transfer of ownership and use of scientific research and technological development results; to advise scientists to determine whether their research results can register for patents, utility solutions and commercialization. Moreover, needing to form linkages through incentives, cooperation policies between university and enterprise, especially startups enterprise, contributing to the creation of value chains through the commercialization of research results of university.

Fourth, continuing to implement the project "Fostering innovation through research, science and technology" (FIRST). In particular, it is necessary to increase funding for research cooperation groups on science, technology and innovation between enterprises and universities in order to support cooperation groups in implementing proposals to implement feasible business projects based on the results of innovation research, closely linking the creative ideas of enterprises with universities. With that support the universities to access and use incentives from national programs on science and technology to improve the quality of human resources and create quality research products. For example: Program to develop science and technology market at the Decision 2075/QĐ-TTg of the Prime Minister (2013), National technology innovation program at the Decision No. 677/QĐ-TTg

of the Prime Minister (2011), Decision No, 1851/QĐ-TTg of the Prime Minister (2018) on the project "Promoting technology transfer, mastering and development from abroad into Vietnam in priority sectors and fields up to 2025 and orientation to 2030", etc.

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