# SCIENCE-INDUSTRY COOPERATION: THE ISSUES OF PATENTING AND COMMERCIALIZATION

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**Abstract**

Advancement of science-industry cooperation is a popular trend in modern world. Developed and developing countries try to boost their economy's growth by the transferring of knowledge between scientists and businesses. Intellectual property transfer is the central area of cooperation between scientific organizations and businesses. It takes place mainly by patent licenses as it allows dissemination of technology to the private sector at market price. Governments may incent researchers to license their inventions by economic stimulus as well as determine conditions – patent regime – on which new technologies are transferred. Undoubtedly, success of science-industry cooperation also depends on research institutions' innovative policies – their practical approaches towards licensing.

Nowadays we could distinguish two commercialization models - supply-push and demand-push models. The second model should be considered as a more effective one as it is based on collaboration between scientific institutions and businesses. Innovative policies of many countries let us conclude that a demand-push model has a greater potential to boost economic development based on innovative ideas.

**Keywords:** Science-industry cooperation, IP transfer, patent licensing, supply-push and demand-push commercialization models

## Introduction

2014 was known as the EU-Russia Year of Science ("Twelve Months of EU-Russia Cooperation in Science, Higher Education and Innovation", 2014). The advancement of science is highly valued in today's world as well as the development of cooperation between companies and research organizations. Science-industry cooperation is one of the basic components of the knowledge-based economy. It is included in all the major indexes of competitiveness and innovative development of national economies (Global Competitiveness Index, Global Innovation Index, Knowledge Index, Knowledge Economy Index, etc.), (Simachev, Kuzyk, Feygina, 2014, p. 7). Economic development based on scientific innovative ideas is the goal that Russia and many other countries have.

The success of science-industry cooperation depends on how supportive its legal framework is. Legal framework could influence on cooperation by reforming higher education systems; creating clusters, incubators and science parks; regulating technology transfer; and encouraging public research institutions to file for and commercialize their intellectual property. In the last three decades the legislative trend to increase universities' and public research organizations' (PROs') contribution to the economic growth has clearly intensified (WIPO, 2011, p. 144). This article concentrates on the central issue that needs to be considered to reach this goal – on patenting and commercialization of inventions.

**I.**

Science-industry cooperation in performing R&D has an over two-century-old history. Through this period of time differing trends in the interaction between universities and research institutions on the one side and companies on the other side have been noticed. For example, long periods when firms were reluctant to cooperate with researchers or periods of active science and business cooperation. For example, before 1960s, intracorporate research was more common than external cooperation with research institutions (Simachev, Kuzyk, Feygina, 2014, p. 6). On the contrary, since 1980s due to growing technological complexity of products and processes, rapid technological change, higher competiveness as a result of higher costs and risks of innovation firms were forced to acquire technologies from universities and public research organizations. These institutions provide human capital and training as well as transfer technology. Firms depend on the contributions of public researches because it produces innovation of commercial significance.

Public-private cooperation occurs through a large number of formal and informal channels. Informal channels include the transfer of knowledge through publications, conferences and informal exchanges between scientists and businesses. Though formal channels include hiring students and researchers from universities and PROs, sharing equipment and instrumentation, contracting technology services, collaborating in research, creating university spin-offs or joint firms, and transmission of IP via such channels as licensing (Foray and Lissoni, 2010, pp. 275-314). We can make a point that intellectual property transfer is not just one but the central area of cooperation between scientific organizations and businesses.

For knowledge transfer to work, firms need to be able to assimilate and exploit public researches. According to a number of studies, big business is more enthusiastic towards this cooperation (Mohnen and Hoareau, 2003, pp. 133-146; Arundel and Geuna, 2004, pp. 559-580; Laursen and Salter, 2004, pp. 1201-1215). This is because it has sufficient labor and organizational resources to support cooperation with R&D organizations (Simachev, Kuzyk, Feygina, 2014, pp. 8-9). Company's age is also an important factor influencing on relationship with research sector. On the one hand, startups are the main providers of innovations (Cohen, Nelson, Walsh, 2002, pp. 1-23). On the other hand, among enterprises founded over 20 years ago there are some who participate in innovative development very actively. For example, among the world's most innovative companies of 2014 there are Alexion Pharmaceuticals (second place, founded in 1992), ARM Holdings (third place, founded in 1990), Unilever Indonesia (forth place, founded in 1930), (The World's Most Innovative Companies, 2014). As well as large industrial companies, big and strong universities and research organizations are more likely to interact in R&D process with businesses. Those research institutions are able to allocate more significant scientific and technological basis and, thus, develop sustainable relationships with businesses (Simachev, Kuzyk, Feygina, 2014, pp. 9-12).

Intellectual property transfer mainly by patent licenses became the main way to cooperate as it allows for formal market-based exchange of knowledge. Licensing provides a channel by which patented technology can be disseminated and utilized at a price negotiated by buyer and seller (OECD, 2004, p. 16). By the way, patents play dual role in science-industry cooperation. Firstly, they facilitate technology transfer through the exchange of licenses on markets for technology (market coordination). Secondly, they play a key role in framing collaborations and alliances (non-market coordination). In non-market coordination the earliest stages, stage of collaboration itself and post-collaboration stage may be identified (Cohendet and Penin, 2011). The main role of patents in the earliest stages of collaboration is to let actors signal their competencies in order to invite potential partners to cooperate. Patents also play a key role in determining the terms of the cooperation. Being a credible

asset, they allow the skills and the bargaining power of each party to be assessed. After the collaboration, patents are used for sharing the outcome of the cooperation through a joint application (Hagedoorn, 2003, pp. 1035-1050).

However, the main aim of a patent is to foster innovative growth by allowing the private sector to use innovation and entitling inventors to profit from their inventions. If researchers do not patent their inventions, government may encourage them to license it to business that will commercialize them. Besides direct influence on innovative development by economic incentives, government determines patent regime which also influences on the successful science-industry relationship. Patent subject matter, patenting requirements and patent breadth are three basic components of patent regimes (Encaoua, Guellec and Martinez, 2003, pp. 1423-1440).

• Patent subject matter is the domain of knowledge that should meet patenting criteria of novelty, non-obviousness and usefulness.

• Patenting requirement is the height of the inventive step required for an application to be granted a patent or the extent or the invention's contribution in particular technology field.

• The breadth of a patent is the degree of protection granted to a patent holder against imitators and follow-on inventors.

Taken together, these aspects compose the strength of patents. Excessively weak and narrow patents might deter business investment in R&D, as they do not prevent effectively imitating of an invention. Conversely, an excessively strong and broad patent on a basic invention may hinder further patenting and using follow-on inventions. By carefully balancing these criteria, policy makers could create a patent regime fostering science-industry cooperation (OECD, 2004, p. 10).

However, not only government could influence on science-industry cooperation, the success of the cooperation also depends on universities' and PRO's innovative policies. "Nine Points to Consider in Licensing" offers some practical approaches for universities to uphold. Among these is the right to practice licensed inventions; structuring licenses in ways that promote technology development; using special agreements for inventions that address important unmet social needs like agricultural, medical and food needs of less advanced countries. Licenses are proposed to be structured as exclusive, co-exclusive (granted to a limited number of licensees) or non-exclusive. Besides, they may be field-restricted (cover only specific areas), convertible exclusive (may be converted to co- or non-exclusive license if a licensee has not marketed an idea on time) or convertible nonexclusive licenses (conversely, may be converted to an exclusive license through a defined period of time). Using particular type of license depends on licensing subject matter. For example, if a technology needs significant investments, it is better to use exclusive or co-exclusive license, if not - non-exclusive licensing can help to maximize benefits of inventions and further develop them ("In the Public Interest: Nine Points to Consider in Licensing University Technology", 2007).

Besides this, universities and PROs are trying a number of interesting additional approaches. These include licensing strategies, free access to research materials and copyrighted works. Some licensing strategies may be highlighted:

1) a preference to grant companies non-exclusive rather than exclusive licenses (Nill, 2002);
2) differentiation in price of licenses - making them cheaper if used for non-profit purposes (WIPO, 2011, p. 173);
3) free licensing for small companies or start-ups;
4) providing hardware licenses.

Licensing represents one of the key elements of the first commercialization model - a supply-push model. In this model inventions are generated by the public research system and then diffused via the sale, transfer or licensing, often on an exclusive basis, to existing firms or new ventures (e.g. academic spin-offs).

The second commercialization model should be considered as a more effective one. It is a demand-pull model based on collaborative research and development. In this model universities, scientific institutions and businesses work together in order to find needed solutions to production and innovation problems. In recent years, many countries have moved towards using this model providing patenting by private sector. The USA have developed technology transfer and licensing offices (TTOs/TLOs) at universities and research institutions in order to enable inventors to found their start-up companies (OECD, 2012). Russia tries to foster its innovative growth by creating Technoparks where resident companies promote their products and services, participate in various exhibitions to attract investors as well as get marketing, accounting, legal support from servicing companies (Zhelobanov D., 2013). The United Kingdom was the first country to have reduced a period of time for patenting environmentally-friendly technologies (fast-track system for "green patent applications"), (WIPO, 2013). In Europe as a whole great attention was drawn to IP and IPR (intellectual property rights) management to provide help to firms that patented their technologies. In this area of expertise the European IPR Helpdesk started to offer free first-line support to small and medium-sized companies across the Europe (Enterprise Europe Yorkshire Network, 2015).

**Conclusion**

Transferring of knowledge between scientific institutions and businesses counts for an over two centuries. Now it is fostering due to increasing technological complexity of products and processes, rapid technological change and higher costs and risks of innovation. Science-industry cooperation includes the exchange of knowledge through formal and informal meetings, hiring researchers, sharing equipment, contracting technologies, research collaboration, and IP transmission.

Intellectual property transfer is one of the key areas of cooperation. Its advantage is that it is market-based exchange of knowledge. Licensing is the most common way of transferring IP as it provides a dissemination of a patented invention at market price. In the process of licensing role of patents is very high. From the one side, they incent the transfer of technology, determine its conditions and outcomes as well as make it real. From the other side, patent subject matter, patenting requirements and patent breadth influence on business involvement in R&D and other aspects of science-industry cooperation. Success of business & science synergy depends also on research institutions' innovative policies. Some practical and innovation-friendly approaches are practicing licensed inventions; differentiation of licenses; having special agreements for some inventions that are of the very high importance for the society.

Licensing represents a supply-push commercialization model. It is traditional model which helps for generated academic researches to be marketed. Though, a demand-pull commercialization model should be considered as a more effective one. It is based on collaborative research and development (R&D) between public and private sector. The key elements of this model are Technoparks, technology transfer and licensing offices (TTOs/TLOs) at universities and research institutions. The second model is more likely to make scientific advances marketable. Moreover, it facilitates joint problem solving as well as opens up new avenues for research. So we should expect that in the nearest future the second commercialization model would be more popular and be prepared to some changes in science-industry cooperation.

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