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Foreign experience of technology transfer and its application in Russia

The article provides an overview of foreign experience in technology transfer and commercialization. It describes the peculiarities and drawbacks of organizing technology transfer in Russia. In addition, the article proposes the directions for applying foreign experience in the country's innovation system.

Technology transfer, foreign experience, Russian practice, innovation infrastructure.

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During the current period of economic globalization the role of scientific research, formation and implementation of new mechanism technologies, and methods of stable economic development is increasing. Technology transfer is one of the main components of economic development. The extent of countries' involvement in the process mostly defines the possibilities of their technological progress and competitiveness. At present, great interest in technology transfer in Russia is linked not only with the improvement of market relations in the economy, but also the country's accession to the World Trade Organization. In order to characterize the development of science and innovation, the term of scientific and innovation potential is widely used in national and foreign practice.

For evaluating innovation development, domestic and foreign practice uses the notion of scientific and innovation potential. The analytic subdivision of the journal "Economist Intelligence Unit" worked out the system of indicators of innovation activity and integral index of innovation development that comprises many factors. [1]. The survey has been held since 2007, and at the moment it provides the most complete set of indicators of innovative development in different countries of the world.

In 2012, the international business school INSEAD and the World Intellectual Property Organization submitted analytical report "Global innovation index of 2012". The survey covered 141 countries, which produce 99.4% of the global GDP [2].

In 2012 Russia ranked 51st in the list *(tab. 1)*, moving 6 points up as compared to 2011. However this position is far from desirable.

According to 2012 results, the rating of the countries by the level of innovation capabilities is headed by Switzerland; Sweden and Singapore are still among the top three countries.

The report notes [2] that BRIC countries should continue to invest in the development of innovations, to bring out their potential to the fullest extent.

Table 1. Global innovation index of some countries in 2012

Rating	Country	Index	Rating	Country	Index	Rating	Country	Index
1	Switzerland	68.2	**10**	USA	57.7	**54**	South Africa	37.4
2	Sweden	64.8	**15**	Germany	56.2	**58**	Brazil	36.6
3	Singapore	63.5	**25**	Japan	51.7	**63**	Ukraine	36.1
4	Finland	61.8	**34**	China	45.4	**64**	India	35.7
5	Great Britain	61.2	***51***	*Russia*	*37.9*	**78**	Belarus	32.9

China is second only to Switzerland, Sweden, Singapore and Finland according to the indicators of knowledge and technology development, however, like India, it has its weak points in innovation infrastructure.

In this respect, it is expedient to consider the experience of Sweden and Switzerland, the leading countries in technology transfer according to the level of innovation capacity and performance.

Switzerland is making great efforts to commercialize its scientific and technological potential. The Swiss government annually increased its expenditures on education, scientific research and technologies on an average by 6% in 2004 – 2007 [3]. The State Commission for technology and innovation (KTI) is implementing a motto 'Science to market' [4]. Serving as an agency for innovations and development at the state level, KTI supports applied research and development (R&D), contributes to the promotion of newly established companies and the development of entrepreneurship in general.

The innovation R&D commercialization in Switzerland is not backed by direct state investments. Private sector plays an important part in R&D funding. Innovation technology transfer into industry takes place along with the provision of support to firms, mainly in the conditions of technology parks. Due to the lack of direct state support to innovations in the business sector, innovation policy tools are focused primarily on applied scientific research. The Swiss association of technology transfer "swiTT", founded in 2003, carries out the exchange of scientific and technological information between national research institutions and private sector [4]. Special centres for the commercialization of R&D results function under Swiss universities.

Sweden is distinguished by the high level of education and qualification of public sector employees, the efficient performance of state institutions and a sustainable political system. The country has a well-developed venture capital market. However, the system of support and incentives to R&D results commercialization through the creation and development of new enterprises is still developed insufficiently.

This resulted in the creation of a whole chain of organizations responsible for the implementation of the policy related to the development of business. Innovation Bridge supports the commercialization of R&D results and provides (limited) funding. ALMI Business Partner provides support to business (not conducting R&D). Industrial Fund is a state venture capital investor. Invest Sweden contributes to the inflow of investments [3].

The main feature of a typical Western technology transfer centre (TTC) consists in the creation of a complete innovation chain, allowing a project to be developed from an idea to a small enterprise with growth prospects. TTC work according to a standard scheme. At the initial stage, the demand for this technology on the market is evaluated, the options for protection are checked. After the research is finished, a detailed marketing analysis is carried out, including the search for potential customers. If the development is considered to be promising, then the key point is to make up a patent application and receive a patent. The next stage

is the decision on the transfer option: the issuance of a license, the creation of a subsidiary or joint venture, the sale of the patent. If a scientist decides to develop an enterprise on his/her own, TCC will help him/her to work out a business plan, register the company, calculate the cost, find suppliers and customers, etc.

In some countries (USA, Finland) technology transfer is legally established as the "third mission of universities" along with education and R&D [7]. If a university does not fulfill this obligation, it is deprived of the rights to its own intellectual property.

In the world practice most universities determine potential intellectual property rights and the distribution of license income between the university, department, inventor and centres. TTC receives 30% of the net license income, which is directed to cover patent costs and other legal costs for property management. At the same time, the economic benefit from TTC activities consists not so much in making profit, as in creating new small and medium-sized enterprises, well-paid jobs for highly qualified personnel, and also in increasing tax revenues of the budget in the course of commercialization.

Independent technology transfer centres, as well as those created on the basis of universities, are united in the networks of technology transfer and support to innovation business. For example, at present, the European network for business support (Enterprise Europe Network – EEN) unites about 250 syndicates, 600 organizations from 50 countries [8]. They provide enterprises with integrated support to business and innovations development, including information services, support to business cooperatives, internationalization of enterprises, knowledge and technologies transfer, participation of small and medium businesses in the European Union framework programmes.

The U.S. has been interested in the issues of technology transfer and commercialization for several decades already, which, according to American experts, was caused by two main factors: firstly, by escalating competition in high-tech sphere on the part of foreign companies; secondly, by the desire to enhance the efficiency of commercial use of research results, obtained in the course of development of federal budget allocations to R&D. The U.S. accounts for 35% of the global R&D expenditures according to purchasing power parity [9].

In the early 1990s the U.S. established the National Technology Transfer Network consisting of the principle national technology transfer centre and six regional centres located in the different parts of the country. The general supervision over their activities is entrusted to the National Aeronautics and Space Administration (NASA) that is aimed to enhance economic performance of the implemented large-scale space projects. The network is of national importance and it provides the necessary support in technology transfer to other interested departments.

All this boosted technology transfer activities at all levels. Positive effects include the increase in the number of applications for inventions involving federal laboratories, the increase in the number of granted patents and the increase of private sector expenditures on scientific research in universities.

The government does not provide direct financial support to technology transfer centres. However, at the initial stage of TTC formation (usually 5 – 10 years), national laboratories and universities provide them with significant financial support, from their own resources directly. Subsequently, as soon as TTC start gaining profit from the R&D results commercialization, the volume of subsidies on their activities is gradually reduced and, ultimately, universities are relieved from the necessity of providing direct subsidies to these centres. In some cases TTC may receive direct or indirect (through a university or national laboratory) financial support from industrial organizations as well.

In Germany the functions of technology intermediaries between laboratories and companies are carried out by various scientific societies and joint research associations in industry [10]. A leading organizational role belongs to the Fraunhofer Society, which includes 58 research institutions [11]. Their activity is funded by the federal government subsidies and revenues from the contract R&D.

The main goal of the society is to promote the introduction of new technologies in industry and carry out nationwide research (for instance, in the sphere of environmental protection and energy conservation). For promoting the access of small enterprises to its services, the government provides them with subsidies in the amount of up to 40% of the full value of the ordered R&D [11].

Local authorities, first of all, the governments of the Länder take active part in technology transfer. In particular, they contribute a lot to the establishment of science parks and innovation centres, considering this activity a most important direction in solving regional development problems.

Many of the state-subsidized intermediaries depend on the financial assistance of third parties as well, and, in order to stay afloat, they explore a broader segment of the market besides the market of technology transfer services. A great number of such agencies, for example, provide the services on organizing training seminars, trade exhibitions and financial consultations, using public promotional programmes. This is why, transfer agencies differ in their structure. In Germany there are over 190 transfer agencies and several hundred other sources of technological information [10] (business-incubators, demonstration and application centres, technology transfer departments under universities, the National Research Centre, the Fraunhofer Society, the Max Planck society, etc.).

The Japanese experience in establishing TTC is also noteworthy, since the country has achieved significant progress in the field of science and industry integration and reflected its cultural traditions in the choice of technology transfer type. The Japanese system of supporting the appropriate level of technology transfer is quite efficient.

The Japanese innovation model has the following structural elements:

a) a clear planning system has been formed (since 1996 the five-year plans for science and technology have been implemented, the so-called Science and Technology Basic Plan, in the framework of which there is a separate strategic programme "Intellectual property", as well as a comprehensive strategy for the promotion of science);

b) venture business laboratories in 45 universities have been established;

c) the agency for science and technologies, the society for the promotion of science have been formed;

d) a comprehensive interaction mechanism "industry – academic science – government" is being implemented [12].

It is considered important to promote the commercialization of R&D results for their practical application by scientific-research institutes: for the last five years the number of joint R&D projects of universities and industry has doubled. Over the last three years almost 450 venture companies have been established [12] that use the results of university R&D. considerable importance is attached to the organization of technologies licensing, creation of special organizations, which transfer the university R&D results into industry.

The experience of the countries, which have achieved considerable progress in technology development and R&D results commercialization, may also be of particular interest.

In China in 1998, technology transfer centres existed only in Tsinghua University and Peking University. At present, every major research university has a technology transfer department, initially financed by the Chinese

Government from the total funds allocated to the university by the Government. This model of TTC funding has been changing in recent years. Today, the majority of TTC function as associated private companies, owned exclusively by universities [3].

The current Russian innovation system follows the Soviet approach to innovation, which can be described as "building on technology" [5]. It envisages such phases as: research and development, pilot production, industrial production, marketing.

However, such an organization does not reach the marketing stage in most cases. This model works only in the conditions of guaranteed demand for the product, existing on a highly regulated market. The innovation process is more complicated in an open market economy. As a rule, it begins with the assessment of business opportunities rather than with R&D activities. This is the model of "attracting demand", that includes a number of stages from a concept to a product with a high demand on the market: a study of opportunities for business, preliminary assessment of the market, preliminary technical assessment, market research, business / financial analysis, product development, design and technological documentation (this is the stage when R&D activities begin), internal testing of a product, market testing, pilot production, pre-production business analysis, launching of a product and its entrance to the market.

The "building on technology" model has several weaknesses. Firstly, it requires significant volumes of investments in a large number of potential innovation processes, only few of which will reach the market stage. Secondly, the "building on technology" focuses on the initial research stage of innovation activities when there is a high risk of scientific work becoming an end in itself. Thirdly, technological process, essentially, starts from scratch and ignores the lessons learned in other areas of activity.

In Russia, the model of "building on technology" in R&D commercialization is used in the activities of TTC operating under institutes and universities. One of the main tasks of TTC consists in "project packaging", i.e. in the transformation of scientific research into a business-project using international standards. Technology transfer centres introduced rare and well-represented technologies to the market. And all of them found a potential buyer only by accident. For the successful commercialization, the process of technology transfer should be based on market demand.

There are two main complementary ways of improving technology transfer and accelerating the innovation process in Russia. The first one envisages the creation of new organizations (or "organizational structures" such as networks and partnerships) for the association and cooperation of existing organizations in order to implement technology transfer.

The second one consists in the creation of efficient tools and mechanisms managing and supporting the interaction between innovation organizations. This includes, for example, a contractual base of intellectual property licensing, the use of contracts, etc. In practice, both approaches are often used simultaneously: in order to license technologies efficiently, many universities and research institutions create technology licensing offices or technology transfer offices.

In recent years the development of the market of technology transfer and commercialization in Russia has received significant information, material and resource support. The main initiatives in the science and technology development have been recognized by the wide scientific community. To illustrate the development of a new market in the country, we can mention the following:

– creation of the databases of scientific and scientific-technological projects, which are based on innovations;

– carrying out the state-subsidized annual selection of promising innovation projects having patent clearance and industrial applicability;

– implementation of activities aimed at explaining the importance of intellectual property rights to the objects created as a result of such projects implementation;

– adoption of the laws on special economic zones, focus on the organization of technology parks in these particular regions [6].

However, the development of innovation economy requires not only an innovation component, but also financial, administrative and marketing infrastructure. Now the RF Government proposes the establishment of several state venture funds that will invest in high-tech enterprises. Such a decision can be relatively efficient. But in order to get high performance, private financial institutions should be also involved, as they can work more efficiently than government venture capital funds.

A complex investment, marketing and management support to the projects of commercialization and technology transfer is a promising direction of the activities for private financial organizations. In this case, the process of technology transfer is considered as part of commercialization process, one of its components, necessary for the promotion of science-intensive, innovation products both on the domestic and international markets. At that, export is particularly important: the expansion of export structure due to the transfer of domestic high technologies creates the conditions for long-term international cooperation. Establishment of the balanced system of technology transfer in Russia will provide a reliable barrier for selling abroad our latest technologies for a song. A Russian developer gets access to foreign investment and acquires the experience of international cooperation necessary for the development of domestic production.

Thus, the development of the country's economy requires the increase of the pace of unique and progressive technologies transfer, the attraction of financial resources for boosting innovation activity. At that, the introduction of innovations at enterprises should be arranged on a systemic basis.

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