InImpact: The Journal of Innovation Impact: ISSN 2051-6002 : http://www.inimpact.org
Vol. 8. No. 1 : pp.116-127 : inkt15-016

International knowledge transfer as instrument of state innovation policy

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Abstract

This article analyses instruments of public policy by which international knowledge transfer takes place. Global scientific potential as a key prerequisite for it is examined in cross-country comparison perspective. Main findings of the study is emerged patterns of technology transfer policy. A hypothesis about positive correlation between the level of intellectual property protection and effective implementation of research and development results is also confirmed in this article. Keywords – technology transfer, knowledge transfer, innovative development, scientific potential, research and development, patent, citation, intellectual property

1. Introduction

Socio-economic development of countries, their economic and political position in the world arena are determined largely by scientific, technological and innovative potential. Developed countries are increasingly separating from the developing world through technological excellence and effective national innovation systems. However, many of the developing countries tend to quickly make up for a lack of innovative capacity through implementation of effective scientific policy, often based on derived practical experience from abroad. In this regard, the importance of international technology transfer (ITT) is difficult to overestimate as:

- the very essence of technology transfer (TT) implies a permanent process of technology motion, which mediates to innovation development in general;
- contemporary TT triggers development of such elements of innovation infrastructure as intellectual organization, market-intellectual enterprises, TT centers, technological platforms, consulting in innovation, etc;
- establishment and development of efficient TT should strengthen the state's position on the world stage and facilitate international cooperation.

Efficiency of TT comes down to the effective knowledge transfer (KT) since TT virtually always implies slight changes in order to fit new circumstances. Thus, the quicker knowledge acquired by staff the more beneficial the search for new technology is [6].

The goal of the article is to identify possibilities of facilitating international knowledge transfer (IKT) by means of state public policy. In order to achieve this goal following tasks are set:

- To review the channels of ITT;
- To conduct cross-country comparison of their scientific potential;
- To reveal obstacles for countries to transfer knowledge.

2. Background

Until nowadays the issue of TT in the light of national innovation policy as well as in the context of world economy development has been rarely considered. In spite of the fact that the importance of TT on the world market is constantly increasing, database allowing to conduct quantitative analysis of international technological flows are absent, except OECD statistics (which is rather limited). Nevertheless there are some studies, which reflect the problem of ITT in one way or another. B. Doroti, P. Rodgers, B. Garreta, P. Dussoga can be attributed to the authors of such works. Acharya, Keller, Hoekman and Javorcik particularly focus on international trade and foreign direct investment (FDI) as means of spreading technologies [1, 8]. Other researchers of imports as a channel of transfer such as Eaton and Kortum pay more attention to producer goods and intangible assets [5]. Labour mobility between subsidiaries and domestic enterprises as one of the way of technology transfer is considered in studies of Fosfuri, Motta and Ronde [7]. Other aspect of TT, namely, intellectual property rights (IPR) is covered relatively better in academic literature (Park, Lippoldt, Watson, Johnstone, Haščič), however the evidence is far from complete. It is important to underline the fact that despite quite great number of studies (fig. 1), holistic approach to the problem has not been yet developed. Moreover, international technology transfer as a part of national innovation policy is considered extremely rare in academic literature.

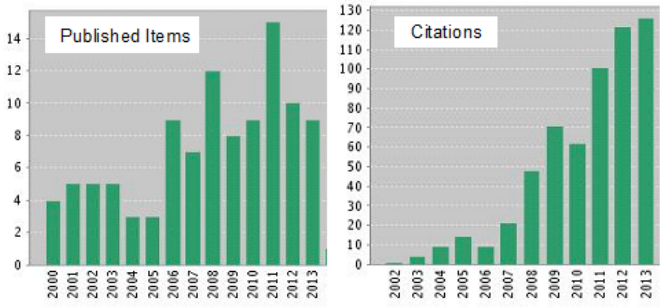

Figure 1. Published and Citations Items on ITT as a part of innovation policy

Gaps in the literature could be linked to the lack of practical and statistical information. Thus, the main distinction of this study is practical perspective and estimation conducted on data that are more recent.

3. International knowledge transfer as a part of state technology policy

IKT is directly linked to national technology policy. Many countries have historically engaged in protectionism nascent industries in more or less latent form, because international law provides for waiver of this policy. Simultaneously, much evidence suggests that an open trade regime facilitates the dissemination of knowledge [12]. The company should have access to imported equipment, which embody the foreign knowledge. But in the case of open markets freedom extends to any products, thus increasing the competition between the imported and interior products and prices may decline as for objective reasons, and due to latent dumping. At the same time, given that the technology markets are associated with enhanced, imperfect competition and externalities, any arguments against the policy of protectionism are subject to debate.

Technology acquisition as well as its diffusion enhances productivity growth. However, as a rule, innovations are generated in OECD countries while most developing countries rely mainly on imported technologies as sources of new productive knowledge. Nevertheless, significant amounts of cost to create innovation and adaptation is observed in the latter countries that stimulates technological change. In this regard, developing countries use national policies and international agreements to stimulate ITT. National policy includes the economic programs of wide purpose (e.g., education) and financial mechanisms, such as funding the creation and acquisition of technology, tax incentives for the purchase of capital equipment and intellectual property, thereby creating conditions for the introduction of technological changes [9]. The available evidence suggests that spillovers are often international [5]. Even if they were inside the country, trade policy is not effective. Instead, the policy aimed at increasing the incentives for actors, create social benefit exceeds the private income, without simultaneously creating additional obstacles, would be more pertinent. However, in practice this happens rarely.

3.1. Policy Instruments

One of the most significant parts of technology policy is licensing and policy of foreign direct investment. Historically, the limits of trade policy is often supplemented by restrictions on FDI. Thus, Japan, Korea, Taiwan (China) all imposed restrictions on FDI in different moments of time. However, policy is often leans toward the other modes, including trade policies that affect machines and equipment and licensing of foreign technology. In practice, many countries are actively attract foreign investors through advances, subsidies, tax benefits and other transfers. In this case, in order to have a basis for such investment incentives implementation, positive externalities from FDI should beobserved in the host country [8].

The predominance of conduct “follow the leader” among multinational corporation provides another potential option to promote FDI. Given the oligopolistic nature of the markets within which FDI occurs, a new participant can attract investments from competitors or suppliers. If so, competition for several stages of production may increase, thereby increasing the efficiency and total production and employment. Often this means that the host country is able to consistently attract FDI from one or two large firms.

Other important element to be considered is IPR. IPR can support the markets of technologies, including the international transfer of knowledge [3]. Patents and trade secrets provide a legal framework identify patentable technologies for subsidies and licensing, promoting the establishment of licensing contracts. Protection of patents increases flows ITT in the country with the technological capacity, as well as shifts the incentives of investors from FDI to licensing [4]. The general trend is that poor countries are unlikely to benefit from strong IPR [10]. Strong patent right may be expected to significantly enhancing the gains earned by international firms as IPR becomes more valuable, obliging developing countries to pay more on average for internal flows of protected technology. In addition, in these countries, external effects from ITT are likely to be minor, in the best case, given the limited purchasing power. This means that in poor countries, policies should be aimed at reducing the cost of imports on intellectual goods and technologies, and to increase the capacity to absorb and adapt technologies.

Subsidies is also a vital element of technological policy. A significant proportion of the benefits of research and development (R&D) may concentrate within the limited space and the company, that leads to the emergence of clusters of innovative activity, often around academic research centers. This may cause the R&D associated with the subsidies and support of fundamental research and training to expand the potential application of funds in the country. Many studies indicate that the absorptive capacity in the host country is crucial for obtaining significant external impact of trade and FDI. Without adequate human capital and R&D investments, a chain reaction may simply be impossible. This leads to the conclusion that trade liberalization and open FDI policy should be complemented by policies in the field of education, R&D and human capital accumulation for countries to take full advantage of ITT. In this context training subsidies assume great importance, incentives for the purchase of technology. For example, Amsden argues that political intervention, including explicit and implicit subsidies, underlie the economic “miracle” in Korea and Taiwan (China) [2]. The matter is that targeted subsidies have enabled governments to promote the key sectors, which became effective in its own sphere and gave positive results. It is important to differentiate sectorial subsidies and general policy to promote the training and development of the enterprise. In a recent retrospective of the past experience of the East Asian development, analysed in the work of Kenneth Noland and Pack [11] shows that the sectorial policy itself has not led to high growth rates of the overall performance of the enterprises.

The overall orientation of the state policy, consists in the selection of priority sectors and that the state supports, including innovation, education, transport infrastructure and other similar public goods. The same is true for policies aimed at promoting socially-useful activities. An important example of which is directly related to the subject - study of externalities. In this situation the market can't invest firms in new (unconventional) activities for following reason: as soon as the entrepreneur is successful in identifying profitable new opportunities of production, appearance of imitators prevents the costs return. If so, subsidies, or similar incentive can promote innovation and initiation of risk.

For the effective use of the policy of «support», it is necessary that the government correctly defined the cases that justify intervention and ensure the implementation of measures accordingly. In practice, governments could be often mistaken in this is the problem - evaluation of the relative sizes of the failures of the state and the market. Among the potential problems can be identified: some subsidies can maintain inefficient projects; that firms can manipulate to win subsidies; and that subsidies can lead to corruption, poor corporate governance and rent-seeking behavior. The biggest problem is the implementation of grants is that they are difficult to control. Opportunities and autonomy of the States play a fundamental role in implementation of effective policy subsidies

3.2. Market failures

On the market of transfer of technology there are three main problems: (i) the asymmetry of information; (ii) market power; and (iii) external effects [8].

Information asymmetry is that the exchange of information, those who passed it can not fully disclose their knowledge, not destroying the basis for a trade that prevents customers to determine the value of the information before the purchase. This can lead to large transaction costs that frustrate the market TT mechanisms. In the international context, information problems are more severe. Monopoly owners of new technologies, acquired based on time, patents, and other intellectual property rights, as a rule, has significant market influence. This necessarily implies that the price of technology may exceed optimal social level (i.e., marginal costs). At the same time, this difference is the profit from innovation. External effects can occur if the costs and benefits from the exchange of technologies are not fully «acquired» by those who are involved. The major share of benefits to recipient countries ITT is not likely to occur due to uncompensated use of technologies, including the counterfeit, which may, for certain items be of the results of reengineering as side effects. Positive spillovers exist whenever technological information, dispersed in the whole economy enough for the development of new technology and the supplier of the technology may not fully recoup the costs.

These market failures imply potential policy aimed at improving the welfare of the population through the promotion of ITT. To be effective, policies must change the incentives for private agents that have innovative technologies for the release of the "right" way. In practice, the potential policy aimed at the improvement of welfare may not be realized due to errors or rent-seeking behavior.

4. Knowledge transfer: global scientific potential

A basic element for KT is R&D level of countries. Various macro indexes on which comparison could be based abound. In this paper own calculations were made with data collected from OECD data base, Science indexes 2013. The most common and quite well reflecting the real situation indicator is Domestic expenditures on R&D (fig. 2). As it can be clearly seen from the graph, R&D expenditures in absolute terms in USA significantly exceeds this indicator in others country, nevertheless as percentage of GDP there is no such big difference. However, almost all EU countries are behind Japan, the USA apart from Finland, Sweden, Denmark and Switzerland.

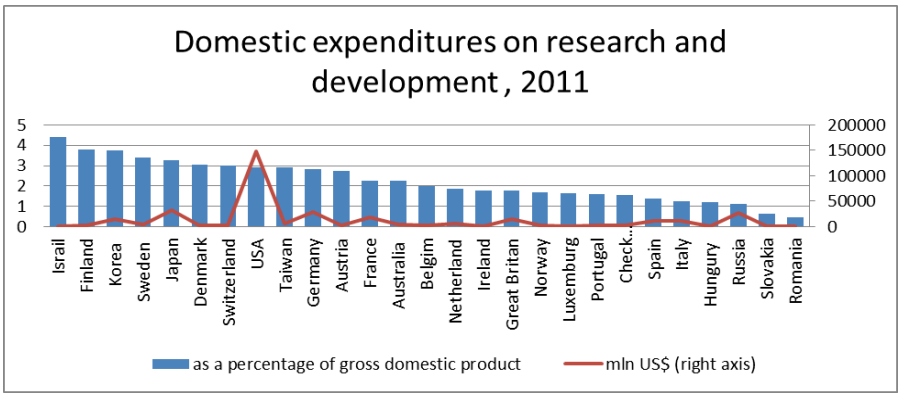

Figure 2. Domestic expenditure on R&D, 2011

Correlations analyze shows that the quantity of publication depends on the number of researchers and expenditures on R&D (fig. 3). In this estimation the panel of 30 various countries was chosen. As it can be clearly seen from the graph, Russia (red mark on chart) is not on or near the trend line: in spite the fact that it situated in group with big expenditures on R&D, the number of publication is essential low. The opposite situation is observed in The UK, where with less expenditure the highest level of publication is shown. This index is worth analyzing in dynamics in order to exclude coincidence and randomness (fig. 4). However, regarding Russia the chart demonstrates virtually stagnant trend apart from slight fluctuation. In comparison, though USA and GB trends are also remaining almost unchanged, their absolute level is much higher. The only surveyed country which enjoyed a significant boost was China gradually reaching the EU level.

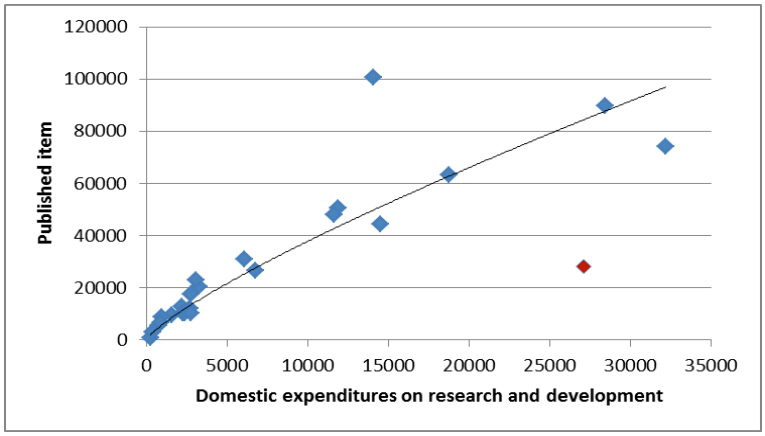

Figure 3. The correlation matrix

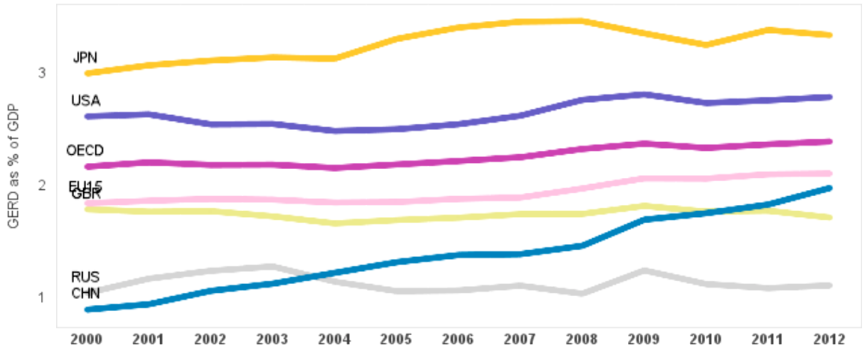

Figure 4. R&D intensity in different countries and regions

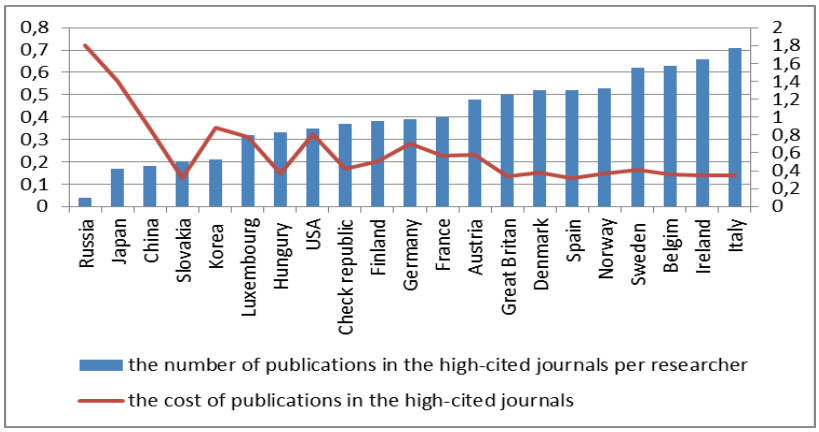

Figure 5. Number per researcher and cost of publication in the high-cited journals

Considering the high-cited journals, the correlation between spending on R&D and the number of publication in such journals is also observed. However, Russia is again out of the trend due to the fact that the share of publications among all publications is extremely minor: only 35% compared with 65% in China and 76% in the USA. As a result, the number of publications in such magazines per researcher turns out to be disastrously low, namely 0.04 [13]. Small wonder that the "cost" of a publication in "strong" magazine in this case is extremely high (fig. 5).

This is only snapshot of the situation in R&D sphere; however, it provides an indicative picture of the world situation in social Sciences and Humanities. It is obvious that low figures and proportion of publications, as well as international cooperation lies not just in the level of development of a scientific discipline, but the extremely low capacity of the country and representing its researchers to influence the course of the world science development.

Above described situation is closely correlated to the problem of intellectual property rights. According to WIPO (World Intellectual Property Organization), intellectual property (IP) refers to creations of the mind, such as inventions; literary and artistic works; designs; and symbols, names and images used in commerce. IP is protected in law by, for example, patents, copyright and trademarks, which enable people to earn recognition or financial benefit from what they invent or create. By striking the right balance between the interests of innovators and the wider public interest, the IP system aims to foster an environment in which creativity and innovation can flourish. To promote this, all countries should continue to move toward protecting and enforcing IP.

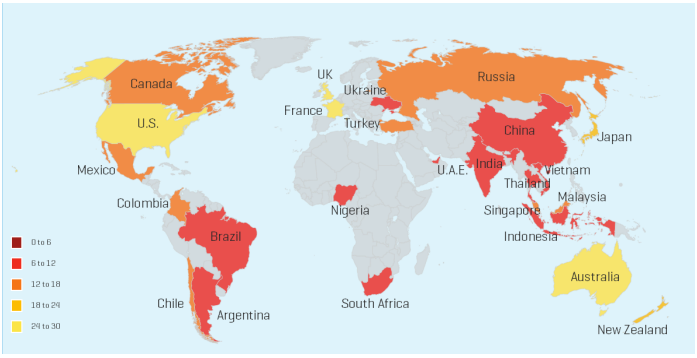

Figure 6. Global Intellectual Property Index 2012

As it can be clearly seen from the figure 6, Canada, China and Malaysia have shown significant improvement in their Intellectual Property System, mainly by means of enhancement legislation. For instance, Canada signed an agreement with the European Union on the Comprehensive Economic and Trade Agreement (CETA), what noticeably enhanced their IP environment. Russia takes a place in the middle group. Nevertheless what counts here is the absolute value of indexes,

which in Russia's case is very close to the bottom line of the group. Despite this, it should be admitted that protecting copyrights in Russia has been strengthening. China, similarly to Russia, recorded progress (especially in patent sphere), but still struggling with overall IP index. IP index in the USA as well as in the UK are approximately twice as bigger as in BRIC country (fig. 6). However, China experienced the greatest growth of that index in 2012 (fig. 7), while Russian index changed less than 20%, left behind only India. Absolute leader at this point is The USA, developing all spheres; second to it, with the little margin, is The UK and France.

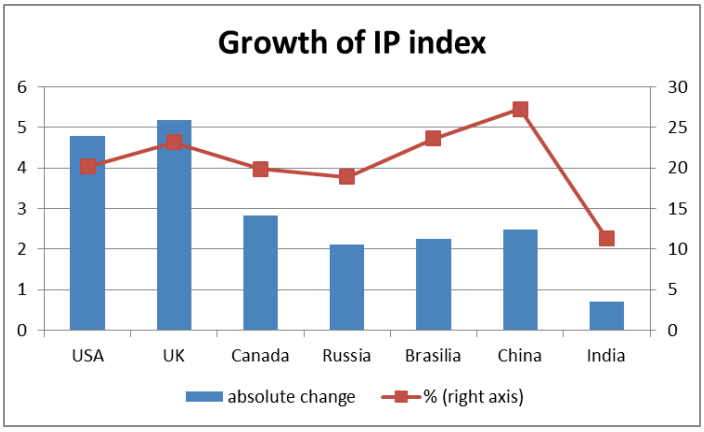

Figure 7. Global Intellectual Property Index 2012

In this light more attention have to be paid for patent data as an instrument for evaluating IKT. This chart (fig. 8) illustrate the strength of a country environment for patents, related rights, and limitations, where maximum score is 7. Expectedly, developed countries with high income show better figures, with the United States as a leader, followed by The United Kingdom, Singapore, France and Japan. The trend sharply dropped from indexes above 3 to countries with less than 2, nevertheless general situation reflects low level of patent environment.

In the context of this paper, it is more important to consider collaboration between countries in researches and as following patents. International collaboration -has a huge influence on the innovation process by giving opportunity to obtain a -wider -volume of -resources and -information at lower cost and sharing risks. It –happens in various –ways depending on -interaction level: from one-way information flows to intensive interaction including formal agreement. Enterprises size tend to be a strong element of foreign collaboration (fig. 9), i.e. large firms have a much higher propensity to collaborate internationally than SMEs, regardless of the overall rate of international collaboration. This is particularly true for Germany, Portugal and Italy.

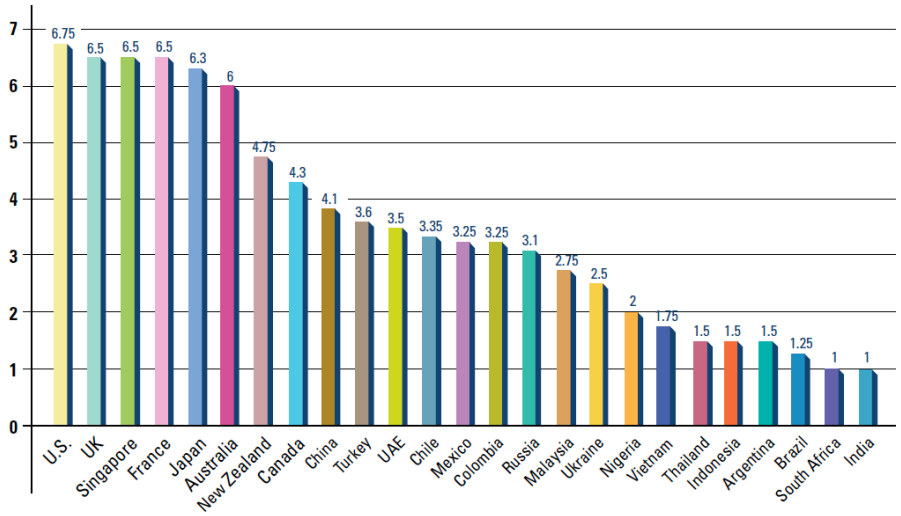

Figure 8. Patents, Related Rights, and Limitations Index

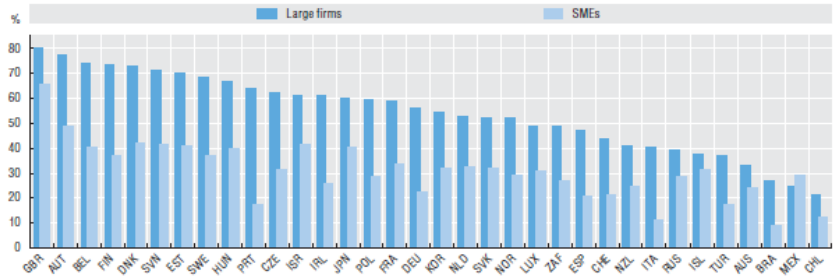

Figure 9. Firms collaboration on innovation activities by size, 2010

Figure 10. Scientific collaboration with BRICS countries, 2001 and 2011

International collaboration can also be examined through co patenting indicators. These focus on the invention stage and provide a complementary view of the collaborative nature of the innovation process. Combining national survey and patent data shows that countries with higher international co invention rates also tend to have higher international collaboration rates, as measured in innovation surveys (34% correlation).

Geographical and cultural proximity influences international scientific collaboration. The widespread use of English and information and communication technologies has helped to extend the scope of international research collaboration. While Europe increases scientific collaboration in the European research area, the rest of the world reaches out to emerging economies. Co inventions are an indicator of formal R&D cooperation and knowledge exchange among inventors located in different countries. International co inventorship is affected by countries' skills endowment and conditions of relevance, especially their IP regimes. International co invention typically involves multinational corporations with units in several countries and joint research ventures between firms and institutions of various types (e.g. universities, public research organisations). While co invention with the BRIICS continues to increase, it remains limited as only about 1.7% of European patents and around 2.5% of US patents are c oinvented with partners in BRIICS economies (fig. 10).

5. Results and discussion

Leaders in innovation development are developed countries with openess to collaboration and sharing knowledge. That indicates that the current developed countries had increased their techologies level due to IKT. Developing countries could follow that practice, however main obstacles for successful technology transfer are lying in domestic enviromnent, for instance poor level of IPR legislation. Mainly these problems contain the lack of absorptive capacity, otherwise new technology would not matched with the existing ones, not only will that not lead to the desired results but also might cause damage. Thus, the choice of TT channels is closely linked to the potential KT, so the acquisition of new technologies abroad depends on their readiness to receive and perceive implicit knowledge associated with their use.

6. Conclusion

KT has became a key factor in maintaining competitiveness in the modern global economy. Furthermore with the emergence of new actors (like China, to some extent Russia), international trade in technology is a major instrument for innovation and knowledge globalization. Several ways are existed to transfer technology, in this research more attention was paid for research collaboration.

7. References

[1] Acharya, R. and Keller, W. Technology Transfer Through Imports. National Bureau of Economic Research Working Paper No. 13086, Cambridge, (2007)

[2] Amsden, A., Asia's Next Giant: South Korea and Late Industrialization, Oxford University Press. (1989)

[3] Ashish, A., Fosfuri, A. and Gambardella, A., Markets for Technology: The Economics of Innovation and Corporate Strategy, Cambridge; MIT Press, (2001)

[4] Correa, C. M. "Can the TRIPS Agreement Foster Technology Transfer to Developing Countries?" Duke University, manuscript, (2003)

[5] Eaton, J. and Kortum, S.Technology, Geography, and Trade,. Econometrica, Vol. 70, No. 5, pp. 1741-1779. (2002)

[6] Evstigneeva L.M. and Kiseleva V.V. 'Knowledge transfer: assimilation possibility of Russia's scientific potential,' Value system of modern society problems and prospects, Westwood, pp. 35–46, (2015)

[7] Fosfuri, A., Motta, M., and Ronde, T. 'Foreign direct investment and spillovers through workers' mobility', Journal of International Economics, Elsevier, vol. 53(1), pages 205-222, (2001).

[8] Hoekman, B., and Javorcik, B., Global Integration and Technology Transfer, World Bank, Washington, D.C. (2006)

[9] Kiseleva, V. V. and Kolosnitsina, M.G. State regulation of innovation sphere. Moscow: Publishing house of SU-HSE. Page. 262 (2008)

[10] McCalman, P. 'Reaping What You Sow: An Empirical Analysis of International Patent Harmonization,' *Journal of International Economics* 55: 161-186 (2001)

[11] Noland, M. and Howard P., Industrial Policy in an Era of Globalization: Lessons from Asia. Washington DC: Institute of International Economics (2003)

[12] Saggi, K. 'Trade, Foreign Direct Investment, and International Technology Transfer: A Survey', World Bank Research Observer 17, 191-235. (2002)

[13] Sterligov, I. 'Scientific policy in figures: in the mirror of the Web of Science (1998-2012)', Scientific policy in figures Blog (2013)