International Review of Management and Marketing

ISSN: 2146-4405

available at http: www.econjournals.com

International Review of Management and Marketing, 2016, 6(S5) 49-60.

Formation of the New Policy of Innovative Development of Kazakhstan in the Context of Current Innovation Models

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ABSTRACT

The goal of current article is to research features of the new models of innovation development, justification of mechanisms and priorities of innovation development of Kazakhstan's economy based on new models of innovation. Due to the opportunities offered by globalization, it seems appropriate in the innovative strategy of Kazakhstan to focus on the rational combination of its own scientific-technological resources and external (foreign) sources of knowledge and technology. This strategy defines the coexistence of two approaches: One approach is associated with the development of the innovative capacity of the country, the other - with the development of absorption capacity. Therefore double-contour mechanism is appropriate for innovative development of the national economy. This refers to the open innovation model and the model of the triple helix. By taking into account characteristics of these models we create two contours of the mechanism of innovative development in Kazakhstan, which differ in accents arranged during the application of country's measures of innovation policy and innovation behavior of companies.

Keywords: Innovation, Innovative Development Models, Technology, Technology Transfer
JEL Classifications: O10, O11, O31

1. INTRODUCTION

In the 21st century Kazakhstan moved to the innovative type of development. According to the classification of the WEF, today Kazakhstan belongs to the second transit group of countries, beginning the transition to an innovation economy (The Global Competitiveness Report 2013-2014) (The Global Competitiveness Report 2013-2014). This is a reflection of the fact that in the last decade Kazakhstan paid attention to the need to move the economy from raw material orientation to an innovative path of development.

A variety of measures designed to significantly expand the scope of innovation is taken. These include a new procedure for research funding introduced by the Law of the Republic of Kazakhstan "On science" in 2011, state support of industrial-innovative activities by the relevant law in 2012 (Law of Kazakhstan on Science 2012; Law of Kazakhstan "On state support of industrial innovation," 2012). Innovation is aimed by the State program of forced industrial-innovative development starting in 2010 and continuing till 2019, and a number of developed programs for its implementation (The state program … 2010-2014 years, Interdisciplinary plan … 2020, The Program on the Development … 2010-2014, Road Map of Business 2020, Program Productivity 2020). New elements of the innovation system are organized in the form of technological parks, higher education institutions of a new type - Nazarbayev University is founded and formation of new clusters is initiated.

Note that Kazakhstan did not face the task of building the mechanism of creation and dissemination of innovations in the market conditions. Therefore it is quite clear that to promote the development of innovation, the measures positively proven

in the countries with developed market economies are applied. In economic theory, this is called the transplantation of institutions (Polterovich, 1998). However, transplantation of institutions does not always lead to the expected results: The institutions, even the most perfect ones being transferred to other economic and socio-cultural environment may become useless.

There is a need for correspondence between institutions and development stages of a particular economy. Without such matching their transfer may be premature. Kazakhstan is at the initial stages of accumulation of competitive advantages, when innovation and investment lie at their basis Therefore, the formal transfer of institutions, typical to developed economies of innovative and post-industrial type, does not give the desired effect on our economy; it only solves the problem of comprehensive industrial modernization.

Institutional innovations that are rapid and not always justified from the standpoint of our reality are common for Kazakhstan. For instance, policy of development of venture capital financing, which is constrained by the underdevelopment of the stock market as a whole. This is a failure in realization of the "cluster initiative," weakly taking into account the character of network clusters. Among the recent initiatives we can mention the approach to creating regional innovation systems, which involves a single scheme of their formation in all regions, without a thorough analysis of the existing conditions.

All of this suggests that there remains a need for further develop of mechanism of innovative development of Kazakhstan, especially in terms of its clearer focus on realistic measures of innovative policy.

It is necessary to consider three points. Firstly, it is a general strategy for the development of the country, and secondly, this is a current situation in the sphere of innovation and possible trends of its change, and thirdly, it is a global development paradigm.

All this underlines the importance of researching the objective preconditions and factors of innovative development in the condition of industrial modernization and identification of the role of the new models of innovation development in the creation of favorable conditions for the emergence of innovations.

2. THEORY

2.1. Appearance of Model of Open Innovation

Recently, the new phenomenon known as "open innovation" has become widespread in the innovative practice of developed countries. Its theoretical understanding led to the formation of "open innovation models," first described in the book "Open Innovations. A new way of creating and using technology" (in Russian "Open Innovations. Creation of profitable technologies") published in 2003 in Harvard by Henry Chesbrough.

Introduction of open innovation models was influenced by various factors. Chesbrough emphasizes several of them such as rising global competition, reduced life cycles of products, increasing complexity of new technologies, resulted in high costs and risks, growth in the supply of venture capital and formation of global value chains (Chesbrough, 2007).

In our opinion, among the factors contributing to the spread of open innovations, we wish to highlight transition from linear to nonlinear model of innovation and formation of the network economy.

2.1.1. Linear model of innovative development

For a long time the process of innovation was considered as strictly sequential passage of innovations by individual stages of the innovative cycle. It was common to understand the cycle as the period from the beginning of the applied (sometimes, exploratory) researches related to the development of some product, prior to the termination of its use among consumers. In general, the whole cycle represents a combination of the following consolidated stages: Theoretical research, applied research, design and experimental development, industry acquisition of new products, entry to market and diffusion (distribution among customers).

This model of the innovation process is called linear (Dodgson and Rothwell, 1994). It dominated during the development of innovation policy in almost all countries. Also innovative policy was limited by acceleration of innovation promotion at all stages of the innovative cycle: Fundamental research - applied research - commercial development. The linear model had disadvantages associated with the fact that many factors and elements of innovation were not included.

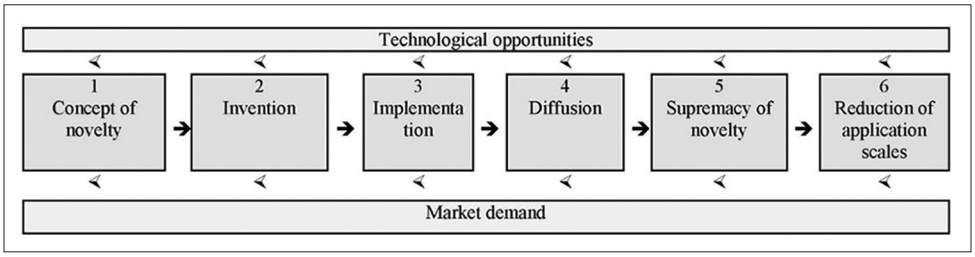
This model did not consider the impact of market and economic activities, the relationship between industry and science, innovation capability, risk and the possibility of use in the given technological and social environment, motivation and opportunities of entrepreneurs.

2.1.2. Nonlinear model of innovative development

Disadvantages of a linear model became apparent in connection with the complication of innovation that involved a wide range of participants. Therefore we came to understanding that innovative process and innovation is not a linear chain of knowledge transfer at stages of the innovation cycle and promotion of a new product on the market, but it is the structure with inverse connections between its constituent units (Figure 1).

In the nonlinear model of the innovation process the movement from an idea of innovation to its realization involves some continually repeated individual stages, whereas others can be omitted. On the other hand, the most frequently repeated step is the research and development (R&D). The science does not act only as a source of innovative ideas, the sphere that precedes and creates prerequisites for innovation, but also as a resource that can be used to solve problems at any point in the innovation cycle. Thus, problems of applied and commercial nature require fundamental research while commercial development can stimulate fundamental research. The main factor in the success or failure of innovations in this approach is the efficiency of the

Figure 1: Nonlinear model of innovative process



Source: Dodgson and Rothwell (1994)

existing links between the different phases of the innovation cycle, between production, science and market.

On the other hand, the innovations are not necessarily the direct result of research, even in the case of very high degree of realization of scientific discovery. The idea of innovation often arises in the enterprises, gaining further development in the course of contacts and interactions with customers, suppliers and competitors, and not solely because of scientific discoveries. Moreover, the knowledge required for the development of innovative processes is different from the knowledge generated in the course of the scientific process. In the first case, they are the result of applying the method of trial and error, repeating the search and gaining experience out of touch with the structures and disciplinary differentiations of academic science (Kenzheguzin et al., 2005. p. 132).

In the nonlinear nature of the innovation process, innovations are increasingly stimulated by the market, not by the science. In other words, the innovation process is formed not only under the influence of technological opportunities ("technological push"), but of the market needs ("demand indrawal"). In the innovation process an important role is played by identifying potential demand for innovations, the organization of their sales, which are solved with the help of marketing. Therefore the traditional linear chain of diffusion of innovation "science - technology - R&D - production - market" takes a different view, such as "market - technology - science - technology - R&D - production - marketing" or "marketing - technology - science - R&D - production - marketing" or any other sequences (Etzkowitz et al., 2000).

2.1.3. Model of open innovations

Along with the transition to the nonlinear model of innovation the emergence of open innovation is significantly affected by changes in the global business environment that is becoming increasingly networked. The modern economy is a network economy, i.e., the economy of not the individual companies, but of their networks. Paradoxically, competing productions are network united, thereby enhancing mutual competitiveness. They cooperate in the stages of R&D, but compete in the implementation of new technologies, in the methods of winning and retaining market.

Technological self-sufficiency as a major goal of development became the thing of the past. It is replaced by a different strategy on? The use of technological interdependence. Cooperation and interdependence have become a means for separating the growing costs and risks of innovation, as well as the concentration of the necessary capacity of knowledge and skills in the development of new products. Close cooperation on the national and international levels led to a change of the traditional nature of innovation processes.

Production and promotion of new products to the world market now demands the construction of global networks including specialized suppliers, the major producers and consumers, connected by technological chain. Rise of internationalization of R&D is observed, and foreign partners are attracted to implement them more actively, but they are often carried beyond the borders of the home country of innovators.

Described processes have led to a model of open innovation, which helps to reduce the cost of resources and time to create and develop new products, increase their market demand, efficiently combine different sources of knowledge (Figure 2).

The model of open innovation is described as a multi-directional flow of knowledge (produced and consumed by the company), intended to encourage domestic innovation and to expand the market for external use of innovation. This model of arrangement of innovation processes allows to intensify circulation of knowledge produced both inside and outside of the company to improve their practical use (Gassmann et al., 2010).

2.2. Model "Triple Helix (TH)"

To enable activation of innovative processes in Kazakhstan, it is also effective to use the model of innovative development "TH" The main subjects of innovation are science, business and government. However, at different stages of the development their role in the innovation process remains unchanged.

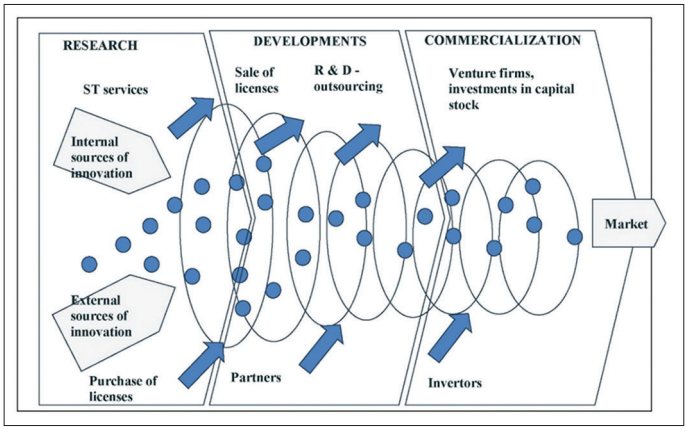
Currently, the development of innovative systems takes place in the direction of strengthening horizontal interactions between government, science and business. Key subjects of innovation are increasingly intertwined, forming so-called TH (Figure 3).

Science cooperates with the government and the private sector, they have mutual influence on each other and together determine the direction and speed of economic development.

The concept of the TH, authored by Itskovich from Stanford University, has been developing since the late 1980s, and today is widely recognized among those who deal with innovative development (Itskovich, 2010; Dezhina and Kiseleva, 2008a; b).

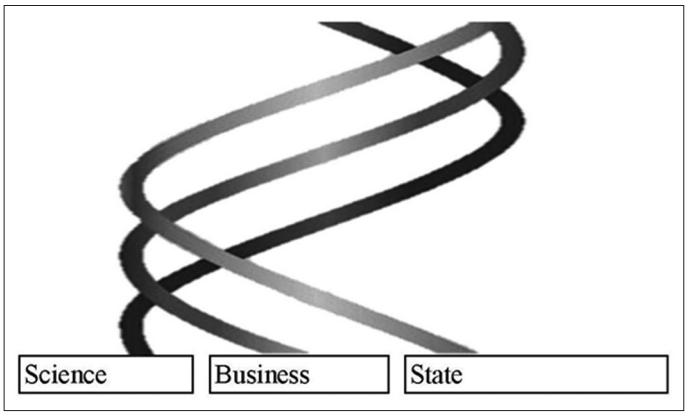
At the center of the model TH is the new role of science as a generator of innovation. Traditionally, the main subjects of

Figure 2: Model of open innovations



Source: Chesbrough (2007)

Figure 3: Model of triple spiral of innovation



Source: Etzkowitz et al. (2000)

industrial policy were considered government and business, but today, when new knowledge has become implemented more quickly, universities came to the forefront. Previously, to implement scientific discoveries into concrete technological solutions it often required time equal to the lives of entire generations. Now, the innovation cycle occurs within a very short time, which allows inventors to participate in the research process, and at the stage of innovation. This phenomenon suggests a deeper involvement of the institutions that generate knowledge in the innovation process.

Moreover, the main institution that generates knowledge in the concept of the TH is universities. And it is not because of the fact that the science in the West has been traditionally concentrated in the universities. The fact that innovation is the process of emergence of new, breaking the old, outdated notions, in the easiest way is given to young people, and they are concentrated at the universities.

Model TH is opposed to approaches, according to which the initiative of generation of innovation belongs to government or business. This model focuses attention on universities as centers generating technologies, and new forms of entrepreneurship.

Model TH considers changes that occur in the innovation processes under conditions of the new economy - the economy of knowledge. Previously, when creating a new product only a small group of scientists and experts in the field of production was concerned in the innovation process. In recent years, the relationship between the processes of creating companies, high-tech sectors and economic growth has significantly increased.

3. METHODOLOGY

3.1. The Use of the Model of Open Innovation in the Global Practice

The model of open innovation concentrates on the central role of knowledge in the innovative process. It is known that the innovation is impossible without the continuous process of improving the skills and knowledge required for the manufacture of innovative products. And the acquisition of new knowledge does not occur only in the course of studies at universities or from professional training. This is so-called "explicit" knowledge. New knowledge can be acquired in the process of obtainment of new skills and new experiences. This kind of knowledge is called "implicit" knowledge and is important for innovation.

The principles of open innovation are widely used by many companies in different industries. Among the most well-known are BMW, Nokia, Procter & Gamble, IBM, HP and Phillips Electronics. Moreover, the innovation emphasizes various organizations - from suppliers and customers to the expert communities, universities, research institutes and partnership firms from other industries, and even competitors (Wallin and von Krogh, 2010).

An analysis of the experience accumulated by these companies permitted us to identify a number of trends, which give a favorable prospect for the development of this innovation model (Gassmann et al., 2010).

1. The transformation of open innovations into leading practices in advanced industries. Open innovations may at first seem like simple outsourcing contracts aimed at cost savings and risk reduction, then later they obtain full format. The pioneers of open innovation were high-tech industry: Information technology, electronics, telecommunications, pharmaceuticals and biotechnology. For example, in computer science, this model was used by Microsoft to create laboratories in university campuses in order to strengthen its ability to absorb external innovations and by Apple to open an access to technologies for its regular users. In the electronic industry the most well-known examples are the park of open innovations by Phillips, the corresponding program of Siemens and initiatives of IBM. The model of open innovations received widespread recognition in pharmaceuticals and biotechnology.
2. These examples resulted in further distribution of innovation in other industries, including machinery, medical equipment, consumer commodities, food processing, construction and logistics. Among these industries, it hugely contributed to the design of consumer products. The openness extends to other areas, especially the integration with suppliers and partnerships with universities.
3. Open innovations are used not only by large companies. This model is being mastered by small and medium-sized

enterprises (SME). The competitive advantage of many SMEs is based on the possession of intellectual property (IP), however they cannot realize that due to its limited scale. The model of open innovation SMEs gain external commercialization of technologies and access to international markets. They may intensify the process of obtaining knowledge, including implicit, during the cooperation with customers, suppliers, partners in research activities at an early stage.

4. An important trend is the extension of partnerships in different organizational forms. The complexity and high cost of modern technologies do not allow even to large companies to develop their own technologies, forcing the creation of various alliances. It perpetuates the practice of the research cooperation, both vertical and horizontal, including other industries. Thus, the well-known recent innovation by Apple iPad has been created as part of an alliance with Phillips and others. Similar examples exist in the telecommunications, automotive and aircraft construction industry.
5. The increasing role of universities as sources of innovation. In many countries, large corporations enhance participation of financing the universities to stimulate the further development of cooperation and accelerate the commercialization of the joint results.
6. Formation of the IP market, which converts from the object of protection into tradable goods. As a result, a secondary market of IP is formed and major auctions are hosted. Patent funds (for example, controlled by Deutsche Bank and Credit Suisse) purchase objects of IP from universities and increase their value through professional management.

Therefore, open innovation can significantly expand the internal base of ideas and technologies and stimulate innovations inside companies. So there comes an opportunity not only to strengthen innovation, but also save time and money through the use of external sources of innovation.

3.2. The Exchange of Knowledge and Technologies

The globalization of technology objectively leads to strengthening the role of external factors of technological development of any national economy. An important element of global economic relations has become inter-country transfers of technologies. In its most active part - trade of patents and licenses - has been growing in recent years, much faster than the normal turnover of international trade. The practice of co-operation has become common, in which R&D can be accommodated in one country, production in other, sales in the third, and management company can be based in the fourth. It is supplemented by increased internationalization of R&D carried out via the participation of foreign partners or even submitted across national borders. The internationalization of R&D has contributed significantly to the development of new technologies, especially in the fields of information and communications, biotechnology, new materials. They can be fragmented, divided into a number of modules, among which critical and auxiliary ones can be identified. In this regard, there is a possibility of transmission of some modules to outsourcing for developing countries, especially those which have certain natural scientific tradition, but do not have sufficient production experience in the field of high technologies (such countries include Kazakhstan).

In the early stages of technological development, globalization covered mainly the countries of the so-called triad: Western Europe, USA and Japan. They accounted for the most part of world's total spendings on R&D, leading research and technology centers were focused in their territories. Since the mid-1990s, processes of globalization of science and technology started to get developing countries involved. There are several reasons that contributed to the development of this process:

- Interest of developed countries in the major growth markets of technologies and products in developing countries.
- Associated development of the productive activities of transnational corporations (TNCs) in developing countries, and hence the need to adapt products to local requirements.
- Possibility of the involvement of local resources, including low-paid technical personnel and a database of traditional knowledge to develop their own research, development of new products and technologies for markets of developing countries.
- "Crushing" and fragmentation of business and innovation, and development of new business models on this basis, including outsourcing and offshoring of business processes.
- Development of local scientific base and building own technological capacity in a number of developing countries.

Technological revolution influenced the activation of processes of technological globalization. In particular, the development of information and communication technologies mitigated or even has broken down the geographical barriers. It gives opportunity to ignore mandatory localization of R&D close to the centers of industrial production and transfer them to other areas, including developing countries.

3.3. Drivers of Technological Globalization - TNCs

Drivers of technological globalization are TNCs, which role was discussed in a special issue of the annual report of UNCTAD about world investments (Polterovich, 2008). TNCs account for 95% of the 700 companies in the world with the largest R&D budgets, they cover almost half of all global spending on R&D and more than 2/3 of all business expenses for this purpose.

Strategies of TNCs are increasingly oriented towards the transfer of not only production units but also the accommodation of innovation and technology centers to developing countries, which are actively involved in the development of new products. Companies from the list Fortune 500 (the largest companies in the US) have opened 98 research centers in China, 63 in India. More than 300 TNCs have offshore development units in India (The Global Innovation Index, 2012). TNCs in developing countries bring not only new technologies, but also civilized business culture, new models of innovation (open innovation, TH innovation).

A new occurrence in the activities of TNCs in developing countries is their focus on the development of new products for the domestic markets of these countries. Thus, western TNCs expect the emergence of a new type of inclusive innovations, available for a

wide range of consumers in developing countries with low levels of income. The traditional strategy of adaptation of basic products of TNCs (glocalization) is gradually being supplied complemented by the development of special cheap goods and services, designed for people in developing countries.

And these innovative products have the required quality to display them first in the emerging markets, and further in Western markets, where they will receive benefits because of their price. These innovations are called reverse innovation, and the re-import of innovations from developing to developed countries is characterized as "innovative boomerang" in the literature (Eroshkin and Petrov, 2012).

Reverse innovations have spread in the production of medical equipment, telecommunications, pharmaceuticals, software and food industry. For example, ultra-portable model of electrocardiograph and ultrasound device developed by general electric for China and India significantly gain in price gain at the price of western analogs and is now coming to the markets of developed countries.

4. RESULTS

4.1. Levels of Innovative Capability of National Economy

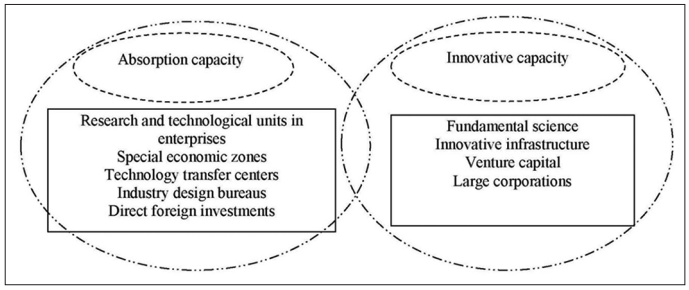
Due to the opportunities offered by globalization, it seems appropriate in the innovative strategy of Kazakhstan to focus on the rational combination of its own scientific-technological resources and external (foreign) sources of knowledge and technology.

This strategy defines the coexistence of two approaches: One approach is associated with the development of the innovative capacity of the country, the other - with the development of absorption capacity. Innovative capacity means the ability of the country to mass production and the use of innovation. The absorption capacity refers to the country's ability of wide borrowing of innovations. Figuratively speaking, in the first case - this is "high road" to innovation, in the second case - the "low road" to innovation.

And in fact, in both cases a common set of factors and institutions is mainly used, but on different emphases (Polterovich, 2008). The main characteristic of the innovative capability is the high role of fundamental science, the existence of extensive innovation infrastructure, the use of risky financial instruments and increase of innovative activity of large corporations. Growth of absorption capacity associated with the development of research and technological departments in the enterprises, the formation of special economic zones, centers for technology transfer and attraction of foreign direct investment (Figure 4).

Given the level of innovative capacity of the national economy, it is reasonable to apply double-contour mechanism of innovative development of national economy, suggesting the use of different models of innovation, organizational forms, institutions, methods of stimulation, etc. for the two goals of the proposed strategy.

Figure 4: Levels of innovative capability of national economy



4.2. Double Contour Mechanism of Innovative Development of National Economy

This is not a strict separation between all the elements of the mechanism, the use of some in the interests of own innovations, and others - solely for the purpose of borrowing technologies. The innovative mechanism includes a common, standard set of tools and techniques, with a certain degree of conditionality divided into two contours. We prefer to use the term contour instead of block, because this concept allows to move away from the strict fixation of the mechanism elements on one or the other strategy objectives of innovative development and to identify the predominant character of the use of certain forms, tools and techniques.

The starting point in emphasizing the two contours of the mechanism of innovation development is the application of modern models of innovation, which were practiced globally in the past few years. This refers to the open innovation model and the TH model. We are going to briefly discuss the features of these models.

The appearance of the model of open innovation is associated with new developments in innovative processes of increasing globalization: Formation of global innovation networks; wide cooperation and partnership on the inter-firm level regarding the R&D; internationalization of R&D, and mobilization of foreign partners to implement them.

The model of open innovation allows reducing the cost of resources and timing for the creation and development of new products, increasing their market demand and efficiently combining different sources of knowledge.

The main advantage of this model is that the innovative processes in a company are open to the external environment. On the one hand, external sources are used for innovation, on the other hand - there is an outflow into the innovation environment, which is created in the company, but for some reason is not used.

Model "TH" reflects the new nature of the interactions between the government, science and business. Key subjects of innovation development are increasingly intertwined, forming a so-called TH. Science cooperates with the government and the private sector, they have mutual influence on each other and together determine the direction and speed of economic development.

Model "TH" focuses on the increasing role of universities in innovative development. If earlier the universities were

considered only as a source of specialists and knowledge, now the entrepreneurial component is presented in their activities. Today, many universities have their own channels for technology transfer and offer educational programs on business creation, incubation programs and other business skills.

By taking into account characteristics of these models we create two contours of the mechanism of innovative development in Kazakhstan, which differ in accents arranged during the application of country's measures of innovation policy and innovation behavior of companies.

Considering the characteristics of these models we created two contours of the mechanism of innovative development of innovations in Kazakhstan, which differ in accents put in the implementation of measures of innovation policy of government and innovation behavior of companies (Table 1).

Emphasizing two contours of the development mechanism of innovations in Kazakhstan does not mean rejection of specific world-known measures, instruments and institutions of innovative policy.

It only means the need to establish a balance between the use of the same tools in the various models of innovation (prior and minor use) (Table 2).

Thus, in our opinion the selection of the two contours in the general mechanism of innovative development allows a more targeted use of both existing and required deployments of various forms and methods to strengthen the innovative susceptibility of our economy.

4.3. Transfer of Foreign Technologies

Considering that in our country there is practically no large company that can independently carry out the entire innovation cycle, the model of open innovation will allow Kazakh companies to develop and produce the type of open innovation, which is built on the integration with external sources.

Therefore, a number of policy priorities can be identified for external sources of innovation. They are foreign technology transfer, the integration into global innovation networks, primarily through entry of non-resource TNCs, use of scheme "raw materials in exchange for technology" and R&D outsourcing.

However, these areas are under development in Kazakhstan. For example, technology transfer is dominated by deliveries of machinery and equipment, simultaneously more complex their shapes, as the acquisition of know-how and licenses has not been developed. In the balance of payments services the acquisition of licenses accounted for about 1.0%.

Foreign technologies transfer is a widespread international practice. It covers the most developed, medium developed and even developing countries. In Kazakhstan, the technology transfer can be done in various forms (Figure 5).

Mastering these forms and channels, it would be undesirable to be limited by a simple "follow the foreign technology." In order to have favorable long-term effects, import of technologies should be accompanied by mandatory improvement, which allows to become an exporter of the concerned product to the foreign market (the process of "inverse innovations").

A movement from simple to complex can be successful in this case. This was demonstrated by the experience of TNCs on the more complicated nature of R&D carried out in developing countries. In 1990 and early 2000s, adaptive works on improving products and technologies to meet the needs of local markets prevailed (the process of "glocalization").

They were mostly based on subcontracting and outsourcing, but were mainly resolved into the performance of quite simple and time-consuming technical support services: Testing, troubleshooting consultation and manufacture of simple components.

Table 1: Double contour mechanism of innovation development in Kazakhstan

Elements and features	1st contour (model of open innovations)	2nd contour (model of TH)
Strategy	Catch-up development	Technological advancement
Character of innovative capacity	Adaptive	Creative
Type of innovations	Step by step, incremental, inclusive	Radical
Technological niches	Raw materials sector and sector of medium technology, partly high-tech	High-tech
Innovation sources	External technology transfer	Domestic R&D
Involved scientific and technological potential	Corporate R&D center, industrial bureaus, government research institutes, laboratories of engineering profile in universities, centers of innovation, offshoring of TNCs	Research universities, national research centers, national research laboratories
Human potential	Engineers, constructors	Highly qualified scientists, including foreign scientists
Financing source	Foreign investments, own funds of enterprises, government support	Institutions of development, government grants, venture capital funds
Innovative infrastructure	FTZ, industrial parks, regional parks, business incubators, industrial clusters	Innovative clusters, FTZ, national parks
Forms and methods of inclusion into the global network of innovation and technologies	Outsourcing, offshoring, creating Kazakh affiliates of TNCs	Formation of international platform of RD

TNCs: Transnational corporations, R&D: Research and development, TH: Triple helix

Figure 5: The channels and forms of technology transfer

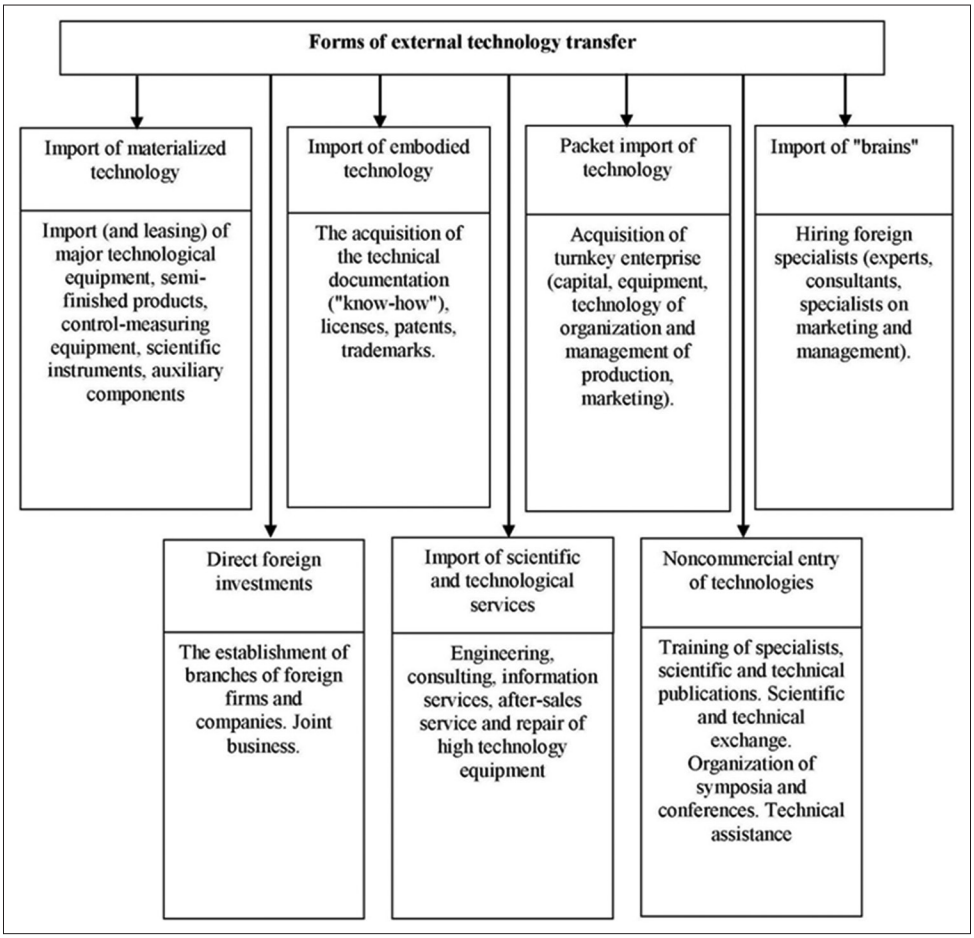


Table 2: Measures of innovation policy in the framework of double contour mechanism of innovative development of Kazakhstan

Measures, instruments, institutes	1 contour (open innovations)	2 contour (TH)
Educational grants	+	++
Scientific grants	+	++
Innovative grants	++	+
Scientific-technical programs	+	++
Technological programs	++	+
Crediting	++	+
Tax concessions	++	+
Venture capital	+	++
Scientific infrastructure	+	++
Techno parks	+	++
FTZs	++	+
Industrial zones	++	+
Technological business incubators	++	+
Industrial design bureaus	++	+
Public-private partnership	++	++
International scientific networks	+	++
Global innovative networks	++	+
R&D Outsourcing	++	+

Developed by authors. ++: Prior use, +: Minor use, R&D: Research and development, TH: Triple helix

In recent years, after the necessary experience of the adaptation processes of technology the research divisions of TNCs in developing countries have started to participate in the development of new products that are displayed by parent company to the world markets.

The gradual accumulation of knowledge, experience and capital will allow Kazakhstan to enter the markets of technologically complex products (Figure 6).

This approach on the distribution of borrowed modern technology along with the modernization of the technical base leads to widespread development of own innovation, gives impetus to the independent deployment of modern trends in science and technology. The result is the acquisition of self-sufficiency in scientific and technological development, which is reflected in the nature of economic development, the structure of the national economy and export.

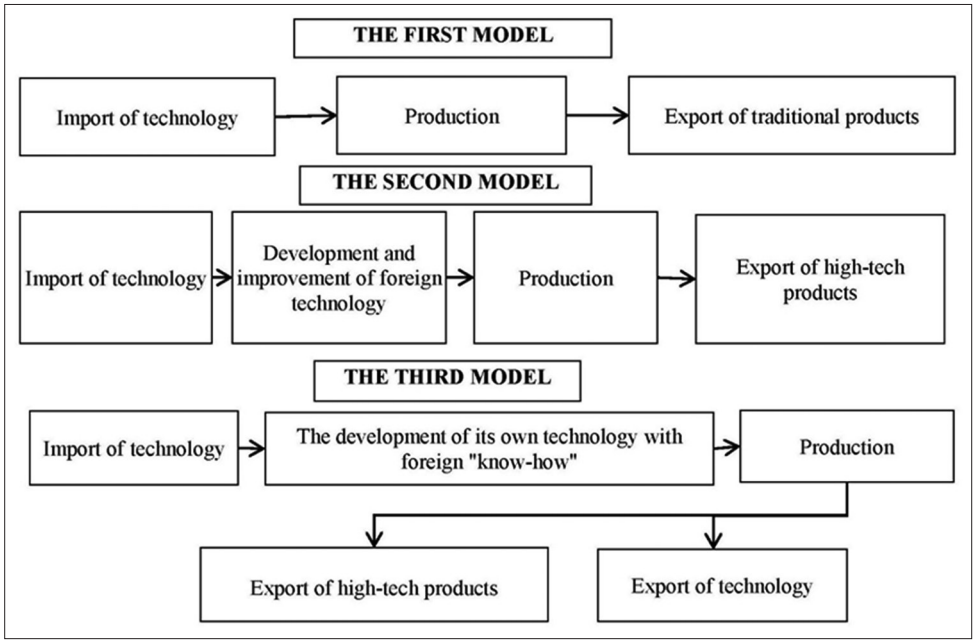
5. DISCUSSION

5.1. Double Contour Mechanism of Innovative Development of National Economy

5.1.1. Model of open innovations

The model of open innovation prefers the strategy of catch-up modernization, according to which the main priority is the modernization and adaptation of abroad technologies already developed and mastered.

Figure 6: Increasing the complexity of technology transfer model (movement towards the "reverse innovations")



The model of open innovation can cover the main stream of innovations in Kazakhstan, but it should be noted that these innovations will not be of a radical nature, and be incremental. Despite this, they can be very useful for the development of technological competence of Kazakh enterprises, primarily the commodity sector and medium technology sectors. This model will help to develop adaptation (absorption) capacity of the economy of Kazakhstan.

It should be emphasized that the actions and decisions in the framework of the model of open innovation allow development of inclusive innovation. Those are environmental innovation, innovative technologies, products and services available for vulnerable groups of society.

Focusing on external sources, the range of innovative services provided in the social sphere and public administration can be increased: Telemedicine, distance education, informatization of social protection agencies, online public services. This will expand the social base of innovation policy by taking into account the interests of those groups whose access to innovation is limited by insufficient income, lack of necessary knowledge, skills and infrastructure.

The model of open innovation is already being used in our country as part of a series of projects FIID (members of which may not even be aware of it). For instance, the joint project "Kazakhstan engineering" and "Euro copter" on production of helicopters in Astana, the project on the production of aircraft for agricultural purposes in Karaganda with Russian participation. Open innovation can be applied in telecommunications, pharmaceuticals, biotechnology, engineering, food processing, logistics and construction.

The main advantage of open innovation model for Kazakhstan is that it allows to step up innovation activities of small and medium-sized businesses, which is very important for our economy. Abroad this model is not only used by large firms, but also by SMEs. The competitive advantage of many SMEs is based on the possession of IP, however they cannot realize that due to limited scale. The model of open innovation SMEs gains external commercialization of technologies and access to international markets. They may intensify the process of obtaining knowledge, including implicit, during the cooperation with customers, suppliers, partners in research activities at an early stage.

5.1.2. Model "TH"

In parallel with the model of open innovation, innovative development can go by the model of the TH but on a much smaller scale, especially in the early stages of development. Creation of prerequisites and conditions is guaranteed for the development of more radical innovations that allow development of knowledge-intensive, hi-tech sector of the economy of Kazakhstan, to form its creative potential.

Features of two models of innovation are responsible for differences in such factors as the type of the scientific and technological potential, sources of innovation, financing channels used by the innovation infrastructure.

Regarding the external factors for the development of innovation on the basis of the TH, special measures are useful to improve the attractiveness of Kazakhstan as an international platform for the implementation of research programs of foreign companies. There may be used different variants, primarily focused on the goal of TNCs to the relocation of R&D.

Typically, TNCs use a step-by-step scheme in foundation of foreign laboratories.

At the first stage, it looks just like the transfer of products from the parent company to the production branches abroad. At this stage,

only the foreign subsidiary performs certain functions to improve the product and technology to adapt to the local conditions.

Then foreign laboratories are founded at the next stage. However, they focus on the creation of innovative products for the local market, and only within the core areas of the parent company. At the third stage, activities of foreign laboratories are globalized, focusing on the development of new products for global markets.

In some cases, this general scheme can be modified. Thus, the introduction of the FTZ regime at Nazarbayev University, along with the infrastructure and qualified staff can be a major motivation to create laboratories of some large TNCs in the field of information and communications, biotechnology and others. For example, the largest Joint Institute of Germany - Fraunhofer Society and telecommunication companies from Finland have interest in creating an engineering center at Nazarbayev University. In this case, there is the potential for the construction of the "TH" with the involvement of international business.

Note that the development model of the TH imposes higher requirements to the composition of the scientific staff, the quality of the scientific and technological infrastructure. In Kazakhstan, the most suitable ones are Nazarbayev University and park of innovative technologies.

5.2. Transfer of Foreign Technologies

Global production-technological and innovation networks are generally initiated by multinational corporations. In Kazakhstan, there are no non-primary production units of TNCs. If they are present in the national economy, it is no more than as value chain. The interests of TNCs are mainly centered on commodity sector and the lower value-added production. In order to implement innovative projects in our country, a special policy of "coercion" of is needed. We should encourage them to transfer their latest technology in exchange for the resources and the opportunity to work in our country. The Kazakhstan 2050 Strategy highlights the need to "allow investors to extract and use our raw materials in exchange for the creation of new industries in our country." In other words, we need to start the mechanism of "raw materials in exchange for technology." Elements of such mechanism were laid in the program of 30 corporate leaders, but were never started. China constantly introduces new "game rules," forcing foreign corporations operating in the country to share their technology with the Chinese state-owned enterprises, particularly in industries such as air transport, energy and high-speed railways, IT and others (Yemelyanov, 2011).

Kazakhstan has particular interest in the use of the experience of oil-producing countries to integrate into the global network of innovation and technology through cooperation with TNCs. For example, many TNCs in Saudi Arabia place offshore centers of innovation there (Chesbrough, 2007). The most famous one is Dhahran Technology Valley. This is a specialized technological cluster focused on oil refining. It is founded by the National University of oil and minerals, and many R&D centers of different TNCs and local ministries are located there. Another example is the Park of plastics technology - a joint venture of the local oil monopoly Saudi Aramco and a Japanese corporation Sumitomo. Such triple partnership of large national businesses, TNCs and local scientific and technological structures will be particularly useful while creating petrochemical clusters in Western Kazakhstan.

In general, we should develop all available forms of cooperation with TNCs. We can start by participating in operational networks, including cooperation in the sphere of marketing and service. By accomplishing this, it should encourage the arrival of the world leaders at the domestic markets - equipment suppliers and service companies, which usually tend to place their service centers closer to markets. For example, those may be major suppliers of oil and mining equipment. A number of foreign companies already operate in the drilling of West Kazakhstan. Interaction with suppliers can begin also with such areas as design, standards, quality requirements.

With the growth of consumption market of technologically complex products, we can expect accommodation of more technologically complex productions in Kazakhstan based on outsourcing and subcontracting, such as testing technology, manufacture of individual components. These are industries that use domestic labor and foreign technology platforms. Further, these markets may organize scientific and technological centers that develop technological products (innovation offshoring). Kazakhstan already has such experience. For example, center of metallurgy in East Kazakhstan (Kazakhstan-French Centre for Technology Transfer), center of the digital engineering, created by Fraunhofer Society (Germany) on the basis of the Caspian University of Technology and Engineering in Aktau.

6. CONCLUSION

6.1. Principles of Economic Pragmatism

Due to the opportunities offered by globalization, it seems appropriate in the innovative strategy of Kazakhstan to focus on the rational combination of its own scientific-technological resources and external (foreign) sources of knowledge and technology. This strategy defines the coexistence of two approaches: One approach is associated with the development of the innovative capacity of the country, the other - with the development of absorption capacity. Therefore double-contour mechanism is appropriate for innovative development of the national economy, which suggests the use of different models of innovation, organizational forms, institutions, methods of stimulation, etc. for realization of two goals of the proposed strategy. This is not a strict separation between all the elements of the mechanism, the use of some in the interests of its own innovations, and others – solely for the purpose of borrowing technologies. The innovative mechanism includes a common, standard set of tools and techniques, with a certain degree of conditionality divided into two contours. We prefer to use the term contour instead of block, because this concept allows to move away from the strict fixity mechanism elements on one or the other objectives of innovative development strategy and to identify the prevalence of the use of certain forms, tools and techniques and to identify the prevalence of the use of certain forms, tools and methods.

6.2. Double-contour Mechanism of Innovation Development

The starting point in emphasizing the two contours of the mechanism of innovation development is the application of modern models of innovation, which were practiced globally in the past few years. This refers to the open innovation model and the TH model. By taking into account characteristics of these models we create two contours of the mechanism of innovative development of innovations in Kazakhstan, which differ in accents during the application of measures of innovation policy of country and innovation behavior of companies. Emphasizing two contours of the development mechanism of innovations in Kazakhstan does not mean rejection of specific world-known measures, instruments and institutions of innovative policy. It only means the need to establish a balance between the use of the same tools in the various models of innovation (prior and minor use). Emphasizing two contours in the general mechanism of innovative development will allow more targeted use of both existing and requiring deployment various forms and methods to strengthen the innovative susceptibility of Kazakhstan's economy.

6.2.1. Model of open innovations

In the model of open innovation the strategy of catch-up modernization is preferred, according to which modernization and adaptation of abroad technologies already developed and mastered becomes the main priority. Despite this, they can be very useful for the development of technological competence of Kazakh enterprises, primarily the commodity sector and medium technology sectors. This model will help to develop adaptation (absorption) capacity of the economy of Kazakhstan.

Simultaneously, but on a much smaller scale, the model of the TH can proceed at the early stages of innovative development. Thus there is a possibility of creation of prerequisites and conditions for the development of more radical innovations that allow development of knowledge-intensive, hi-tech sector of the economy of Kazakhstan and formation of its creative potential. In this regard, a number of policy priorities for use of external sources of innovation can be identified. They are foreign technology transfer, the integration into global innovation networks, primarily through arrival of non-resource TNCs, use of scheme "raw materials in exchange for technology" and R&D outsourcing. In Kazakhstan these areas are still under development. For example, transfer of technology is dominated by deliveries of machinery and equipment, at the same time more complex forms, such as the acquisition of know-how and licenses have not been developed.

6.2.2. Model of TH

Currently, the development of innovative systems occurs in the direction of strengthening horizontal interactions between government, science and business. Key subjects of innovation are increasingly intertwined, forming a so-called TH. Science cooperates with the government and the private sector, they have mutual influence on each other and together determine the direction and speed of economic development.

Model of "TH" focuses on the increasing role of universities in innovation development. If earlier the universities were considered only as a source of specialists and knowledge, now the entrepreneurial component is presented in their activities. Today, many universities have their own channels for technology transfer and offer educational programs on business creation, incubation programs and other business skills. First of all, the development of the "TH" in Kazakhstan is the realization of the initiatives of President Nursultan Nazarbayev on development of Nazarbayev University and other research universities, the creation of "Business and Science 2020" roadmap.

6.3. Transfer of Foreign Technologies

A special policy of "coercion" TNCs is needed for the implementation of innovative projects in our country. It should encourage transferring their latest technology in exchange for the resources and the opportunity to work in our country (the mechanism of "raw materials in exchange for the technology"). In general, we should develop all available forms of cooperation with TNCs. We can start by participating in operational networks, including cooperation in the sphere of marketing and service. For this purpose we should encourage the arrival of the world leaders to the domestic markets - equipment suppliers and service companies, which usually tend to place their service centers closer to markets. With the growing consumption of technologically sophisticated products, it is expected to accommodate more technologically sophisticated production in Kazakhstan through outsourcing and subcontracting. Further, there may be scientific and technological centers that are developing technological products (innovative offshoring).

Special measures aimed at increasing the attractiveness of Kazakhstan as an international platform for the implementation of research programs of foreign companies are required. Different variants can be used, primarily focused on TNCs to the relocation of R&D. Thus, introduction of the SEZ regime at Nazarbayev University, along with the emerging infrastructure and qualified personnel can be a major motive for the creation of a number of large TNCs laboratories in the field of information and communications, biotechnology and others.

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