Main Trends in Development of Kazakhstan National Innovative System Under the Current Conditions

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Abstract The developed countries' experience shows dependence of effectiveness of the national economy on its innovative development. Formation of the National Innovative System (hereinafter "NIS") is the primary objective for countries taking into account availability of correlation dependences between innovation of the national economy and quality of life of the people. Building of a national innovative system has become a political task and requires extensive analysis for Kazakhstan aiming to enter the top 30 most competitive countries.

1 Introduction

In accordance with the USA approach, in a narrow sense, an innovative system is considered as a scientific and technological system including, above all, institutes generating new knowledge. The European school envisages not only production but

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also dissemination, acquisition, and application of knowledge through the processes of training between economic subjects, experiments, and improvement of technologies and products during their usage. It is proposed to conduct the research of the NIS in dynamics as a process of transformation step by step of one complex of institutes to another one or as a process of radical institutional changes.

The aim of building an innovation system is connected with its function to provide the economic growth of the country by production of knowledge.

Innovative system is an open system that is closely connected with other several systems such as production system, financial system, labor market, or system of industrial relations and dependent on their positive effect. The main objective of the innovative system is to make a contribution to increment the growth of the economy by production of knowledge that is especially useful for *modernization and renovation of the system of production, products, services, and processes*. The capability of the innovative system to implement its own modernizing function also depends on the positive effects of its *environment* such as the system of education, science, legislation, and culture. It can be concluded that for correct analysis of innovative system we should understand it as an *open system* closely connected with several other systems.

The interdependence of the NIS elements supposes the following: private sector develops technologies based on own researches and masters innovations. A government provides support for production of fundamental knowledge and strategic technologies and takes part in building of infrastructure and favorable institutional conditions for innovative activities of private companies.

2 Latest Research and Publication Analysis

Analysis of Latest Publications The concepts of innovative systems arose in the west in the 1980s and actively were developed in the 1990s of the last century by such scientists as Freeman (1987), Freeman and Soete (1990), Metcalfe (1995), Lundvall (1992, 2000), Lundvall et al. (2006), Kaukonen and Nieminen (2000), Nelson (1993), and Patel and Pavitt (1994).

Goal of Research The analysis of the publications has demonstrated the existence of various definitions of the NIS proving that up to now there is no unified point of view on the essence, structure, and functions of the NIS, which, to a largely extent, is determined by national peculiarities. The goal of this research is to reveal tendencies in building the national innovative system, stages, and specific features, conduct comparative analysis of innovative activity, and identify the issues and ways of its development in Kazakhstan.

Object of the Research
The object of the research is the tendencies of development of national innovative system, as an object of the research, the organizational, economic, and

administrative communications and the relations arising in development of national innovative system in modern conditions of globalization act.

Methods for the Research

In the course of research and the analysis of information methods of the comparative, logical analysis, a method of generalization and system approach was applied.

Key Research Findings

The NIS national peculiarities are connected with the role of the government and private sector and large and small business in production of knowledge, proportion of fundamental and applied researches and development works, dynamics of development, and industry-specific structure of innovative activities.

In Kazakhstan, the innovative system has built two stages. During the first stage (2003–2009), the law "on state support of innovation activities," the first strategy of industrial and innovative development up to 2015, and programs for building national innovative system of the Republic of Kazakhstan for 2005–2015 have been developed, and technology parks, first experimental design bureaus, and parks of innovation technologies have been created.

During the second stage (2010–2014), legal framework has been further formed; infrastructure programs and mechanisms have been developed, and first significant results have been obtained. Years 2015–2019 will be the third stage of the NIS development in Kazakhstan (Seitkassimov et al. 2015; Ivanova et al. 2006; State Program of Forced Industrial and Innovative Development of the Republic of Kazakhstan 2010; Yegemberdieva et al. 2012).

Among peculiarities of building the NIS in Kazakhstan, it is worthy to note that due to feudality of development and agrarian specification Kazakhstan rather did not have the basis for creation of innovations. And Kazakhstan has to build newly the innovative system. There are also pluses: there is no need to adopt an old infrastructure. During the last period, a new institutional structure of the NIS has been built.

The NIS structure of Kazakhstan includes development institutions, design bureaus, technological parks, and special economic zones.

According to the efficiency analysis of Kazakhstan, innovative system conducted based on the data provided by the Committee for Statistics of the Ministry of National Economy of the Republic of Kazakhstan, currently, there are eight regional technological parks in the oblasts with total area coverage of 87.3% including share of innovative companies of 50% (National Science Report 2014).

The government's interest is shown in the maximization of economic effect of innovation activities and necessity for arrangement of monitoring the innovative process based on the principles of system, interaction, and building feedback with subjects of these activities.

State support of domestic science is carried out by increasing of expenditures for formation of the innovative system's elements. They have been increased from 1.9 up to 66.4 billion tenge from the state budget for 2000–2014 (see Table 1) (Science and Innovative Activities of Kazakhstan 2010–2014 2015).

Table 1 Key indicators of the science status and development

	2010	2011	2012	2013	2014
Gross domestic product (bln tenge)	21,815	27,571	30,347	35,275	39,040
Domestic expenditures for researches and development works in current prices (mln tenge)	33,466	43,351	51,253	61,672	66,347
In % to gross domestic product	0.15	0.16	0.17	0.17	0.17
Number of organizations conducting researches and development works	424	412	345	341	392
Number of staff engaged in researches and development works (by the end of the year)	17,021	18,003	20,404	23,712	25,793
Including researchers	10,870	11,488	13,494	17,195	18,930
Including doctors of science	1341	1486	1065	1688	2006
PhD	59	95	131	218	330
Candidates of science	3012	3286	3629	4915	5254
Profile doctors	–	–	719	605	596
Fixed assets of organizations engaged in researches and development works (mln tenge)	22,811	29,527	37,950	–	–
Average monthly nominal salary of the employees by type of economic activity, tenge in researches and development works	103.571	121.39	148.53	153.56	171.62
In higher education	71.05	87.4	102.0	110.0	117.0

During the recent years, share of the expenditures for science has been 0.17% of the country's GDP, while share of the expenditures should be 1–1.5% of the GDP for developing countries as recommended by the International Academic Council. In Russia, this indicator is 1.3% of the national GDP; in China, 1.4%; in Germany, 2.5%; in the USA, 3.8%; and in Japan, 3.3%. Unfortunately, Kazakhstan comes short in this indicator not only to developed countries but also to some developing ones. Researches have noted that Kazakhstan is still at the fourth technological mode which indicates low science effectiveness in Kazakhstan and its weak relations with real economy.

According to Table 2, effectiveness of researches and development works was growing from 2010 to 2013, and in 2014, reduction is observed by the number of applications submitted and copyright documents issued.

Important indicators of innovative activities by OECD assessment are number of publications and their citation. According to country rating by the number of publications in Web of Science base for 2010–2014, Kazakhstan is at the 94th place (2523) against the first place of the USA (2,763,847); the number of publications per 1 mln persons is 157 (Table 3).

Share of scientific publications of Kazakhstani researchers in the world is only 0.02%, while the USA has 22%; China, 10.2%; Japan, 6.1%; and Russia about 2% (Science and Innovative Activities of Kazakhstan 2010–2014 2015). Based on the data of the Committee for Statistics of the Ministry of National Economy of the

Table 2 Effectiveness of R&D

	2010	2011	2012	2013	2014
Applications for inventions submitted	1850	1600	1468	2036	2012
In % to the previous year		86	92	139	99
Copyright documents for invention issued	1868	1887	1400	1500	1504
In % to the previous year		101	74	107	100
Invention activity coefficient	1.16	1.0	0.09	0.12	0.11
Dependency ratio	0.09	0.13	0.98	0.12	0.16
Applications for granting utility model patent submitted	133	143	182	208	203
Utility model patents issued	116	123	126	163	165
Invention activity coefficient	0.08	0.09	0.11	0.12	0.12
Dependency ratio	0.49	0.83	0.65	0.63	0.46
Applications for design copyright documents submitted	250	257	238	361	300
Design copyright documents issued	260	270	274	280	282
Invention activity coefficient	0.15	0.16	0.17	0.17	0.17
Dependency ratio	0.68	0.89	1.0	1.62	1.8
Applications for selection patents submitted	65	164	105	79	152
Selection patents issued	79	50	67	122	97
Invention activity coefficient	0.04	0.1	0.06	0.05	0.11
Dependency ratio	0.08	0.025	0.18	0.045	0.39

Notes: (1) Invention activity coefficient—number of domestic invention patent applications submitted in Kazakhstan per 10,000 persons (National Innovative System and State Innovative Policy of the Russian Federation 2009)
(2) Dependency ratio—proportion of number of foreign and domestic invention patent applications submitted in Kazakhstan (National Innovative System and State Innovative Policy of the Russian Federation 2009)

Table 3 Dynamics of research activity of Kazakhstan compared with other countries[a], units

	Total number of citations				
	2010	2011	2012	2013	2014
Azerbaijan	1410	1339	1125	849	143
Belarus	3964	3300	2049	2198	467
Kazakhstan	772	397	154	776	164
Kyrgyzstan	228	96	45	188	18
Russia	82,266	46,182	12,503	–	9379
Tajikistan	121	52	12	70	13

[a]2010–2013—according to Scopus (Elsevier) database; 2014. According to InCites (Thomson Reuters) database

Republic of Kazakhstan, the number of innovatively active enterprises increased in 2014 by 3.4 times compared to 2010 in Kazakhstan (Table 4).

According to the National Science Report (National Science Report 2014), 4878 R&D was implemented in 2013. The most part of which was registered by the following industries: economics (8.6%); medicine (6.7%); agriculture, forestry, and education (by 6.6%); law sciences (5.6%); and chemical technology (5.1%) (Fig. 1).

Table 4 Key indicators of innovative activities

	2010	2011	2012	2013	2014
Total enterprises (units)	10,937	10,723	21,452	22,070	24,068
Number of enterprises with innovations by all types (units)	572	762	1622	1744	1970
Level of innovation activity (in %)	5.2	7.1	7.6	8.0	8.1
Number of enterprises with product and process innovations (units)	467	614	1215	1062	1303
Level of innovation activity (in %)	4.3	5.7	5.7	4.8	5.4
Share of innovative products in total volume of industrial production (in %)	0.65	0.85	1.25	1.64	1.5

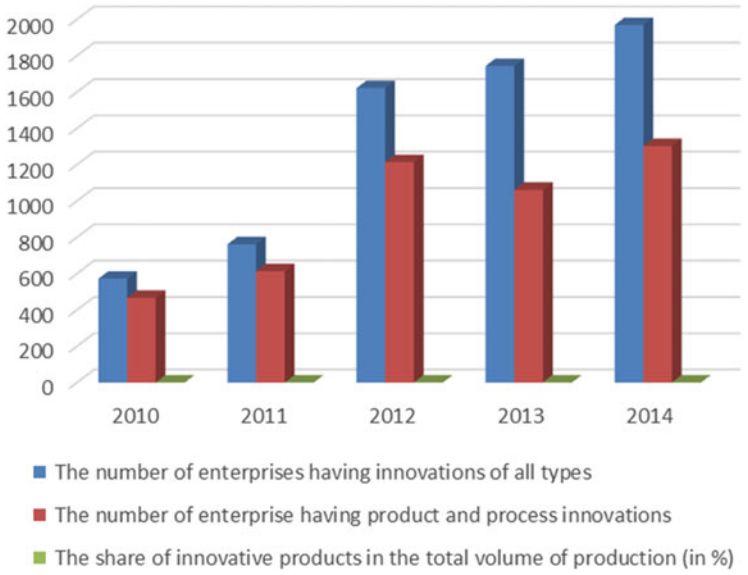

Fig. 1 Share of innovational products

The number of enterprises with product and process innovations grew by 2.8 times for 2010–2015. Innovative products were manufactured to the amount of 4 million dollars of the USA. And share of products newly implemented or significantly technologically modified was more than 91%.

3 Findings and Perspectives of Further Researches: Conclusions

Kazakhstan as an established state at a new stage of own development in terms of global challenges of the twenty-first century is needed in cardinal renewal of the driving force of development based on implementation of new massive industrialization. Neo-industrialization shall become the key content of modern industrial policy oriented at rate of growth, a scale-up of social and economic development of the country at the cost of increase of labor efficiency based on innovations.

However, the NIS of Kazakhstan still has a number of weaknesses, the main of which are the following:

- Low level of financing of science with ineffective control for the resources allocated due to the lack of coordination of industry-specific authorized and innovative organizations
- Lack of legal framework regulating relations of science, education, and manufacturing
- Low share of private sector in science development

4 Recommendations

Based on the experience of many world countries, Kazakhstan has defined the vision and plan of further actions related to innovations in the concept of innovative development up to 2020. Under this concept, it is supposed to promote generation of innovations in Kazakhstan, provide further development of leading innovative clusters, develop perspective technological directions, strengthen regional innovative systems, provide use of raw potential of the country to attract newest technologies, and create high-tech productions.

Neo-industrialization in Kazakhstan shall provide combination of own scientific and technical resources and external technology sources. In this regard, it is useful to use the experience of China, India, Brazil, and others that skillfully use possibilities provided by globalization of technological development by implementation of the strategy for regional transfer and inclusion in global technological chains (National Innovative System and State Innovative Policy of the Russian Federation 2009; Dnishev and Alzhanova 2013).

It is also necessary to create the following to solve the tasks of innovative development of the country's economy:

- System of financing that encourages real benefits from inputs and more efficient interaction between two sectors—science an real economy
- Powerful science and technological complex in scientific researches and technologies in priority areas
- Development of institutional structure

In general, formation of the NIS is a crucial stage of building a national economy which is based on acquisition and use of new knowledge. This concept combines the key elements of scientific, creative, and innovative activities of the country. Thus, the NIS enables to look at the process of building an economy of a new type systematically and, in particular, at changes of the principles of human resources management.

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