National Innovation Activity as a Factor of Sustainable Development – Case Study of Kazakhstan

Turginbayeva Ardak Nesipbekovna
Kazakh National University, Kazakhstan

Abstract: This research will analyse basic components of national innovation activity in contemporary conditions and also their influence to the sustainable country development. Several authors have written calculated derived indexes which realistically characterise the innovation activity of Kazakhstan. In the research indexes of innovation activity were used in Kazakhstan from 2003 until 2006, also descriptive and mathematical data analyses were conducted. The discussion is concentrated on the determination of the indexes such as innovation capacity, innovation return of the industrial product, quota expenditure for the technological innovations in a volume of innovation production and others. Conclusions and recommendations might be useful for the government organs of the Republic of Kazakhstan, in the forming of the Industrial-innovation development Strategy on the base of objective assessment of the contemporary level of innovation activity of the economic branches, and also for analysts and tacticians in the developing countries.

Keywords: National innovation activity, Innovation products, Innovation capacity, Technological innovation, Sustainable development, Gross domestic product, Industrial products, Developing country, Kazakhstan

1   Introduction

Under the present conditions, characterized by establishment of the new information economics, the permanent increase of weight and influence of the innovation activities occurs. Intensification of the scientific and technical progress, especially in industrial developed countries, evidences the fact that the innovation type of development is the determinative for them and the economics, respectively, becomes more sustainable.

Strategic purpose of the Kazakhstan economics development is currently connected with formation of competitive industrial complex based on the high technologies. Passing the barriers in the process of transfer from the raw economics to the post-industrial one is possible provided modernization of the production sector, formation of its progressive structure. As it was noted by Mr. N. Nazarbayev (2007), the President of Kazakhstan, in his latest Message to the Nation, the problem of efficiency of the innovation system under the condition of modernization of the Kazakhstan economics and its orientation to foreign markets is still considered to be among the most actual problems. The necessary condition for implementation of the innovation process is increase of the innovation activity of entities of the economical activity.

General parameters of innovation nature of the Kazakhstan economics for the last years reflect its stable development. According to the information issued by the Agency of Statistics of the Republic of Kazakhstan, as of January 1, 2007, 505 out of 10591 enterprises of the Republic had been the innovational-active. The parameter increase was equal to 43.4% in comparison with the last year. If in the year 2003, share of innovation active enterprises was equal to 2.1%, then in the year 2006 it came to 4.8%. The volume of sold innovation products in the year 2004 was increased by 14.9 % in comparison with the previous year; in the year 2005 it increased by 61.1% and in the year 2006 it increased by 29.6%. Expenses related to both research and elaborations, as well as with technological innovations also has the tendency of increase: 125.2% (the year 2004), 147.6% (the year 2005), 115.2% (the year 2006) – internal expenses related to research and elaborations; 131.3% (the year 2004), 189.7% (the year 2005), 119.3% (the year 2006) – expenses related to the technology innovations (Table 1).

It is required to note that the general picture of the innovation processes in the country as of January 1, 2007 is defined by two industries – metallurgical (39.5% out of the total innovation products of the

Table 1   Main parameters of innovation nature of the Kazakhstan economics

	2003	2004	2005	2006
Gross domestic product volume, in % to previous year	109.3	109.6	109.7	110.6
Volume of the sold innovation products, million tenge	65020	74718	120408	156039
Share of innovation-active enterprises, %	2.1	2.3	3.4	4.8
Internal expenses related to research and development, million tenge	11643	14579	21527	24799
Expenses related to the technological innovations, million tenge	26933	35360	67088	79985
Number of personnel dealing with research and developments, people	16578	16715	18912	19563
Expenses related to science, % of the Gross domestic product	0.25	0.25	0.28	0.24

Source: The Agency on Statistics of the Republic of Kazakhstan (2007).

Republic of Kazakhstan) and the mining industry (19.6%). The second group leading in sale of innovative products includes the industries having the relative weight over 8%: manufacture of transport means and equipment (8.8%) and the machine building industry (8.4%). The third group included manufacture of other non-metallic mineral products – 6.0%, food production industry – 4.7%. Outsiders included manufacture of skin, skin products and shoes (2.4 million tenge, or 0.001% of sold innovation products) and production and distribution of power, gas and water (no innovation products had been sold at all).

Analysis of expenditures related to research and elaborations on sectors of activity has shown the clearly marked asymmetry of the Kazakhstan and Western practice of making research and elaborations. Russian scientists (Balatski, E. and Lapin, V. (2004)) argue, that in the USA, 68.2% of expenditures related to research and elaborations are made by the industrial companies, and the rest belongs to governmental enterprises and other sources. In Kazakhstan the entrepreneurial sector has the auxiliary role (35.3%) (Table 2).

In comparison with the countries of the South-East Asia, the difference even increases: share of Japan industrial enterprises in expenses related to research and elaborations is equal to 72.4%, in South Korea it is equal to 73%. The above provision contradicts the general international tendencies. Paradox of the situation is the fact that the sufficient part of technology elaborations in Kazakhstan is performed by those who will not adopt and use these technologies in the every day process. And the State having taken the responsibility on innovations does not effectively watches the compatibility of developments themselves. This fact is

Table 2   Internal expenses related to research and elaborations on sectors

Year	2003	2004	2005	2006	
				Million tenge	Relative weight, %
Total Kazakhstan internal expenses related to research and elaborations, million tenge	11643	14579	21527	24799	100
Including on sectors of activities: - state	7157	5985	9840	12798	51.6
- entrepreneurial	**3361**	**6348**	**8457**	**8746**	**35.3**
- higher education	1054	2074	2940	2989	12.1
- private noncommercial	69	170	289	265	1.0

Source: Agency of Statistics of the Republic of Kazakhstan (2007) 'Science and innovative activity of Kazakhstan in 2006' *Statistical collection*, Astana, Kazakhstan.

reflected by the information issued by the Agency on Statistics of the Republic of Kazakhstan for the year 2006 according to which only 21.3% out if the produced innovation products and 5.6% of innovation nature services are demanded abroad (Figure 1).

In case of comparison of this parameter with the data from the leading countries of the world, the perspectives of Kazakhstan integration into the world society will not be considered as completely realistic. Meanwhile the most developed countries are aimed at the high relative weight namely in the scientific products on the international market. Thus, Kazakhstan authors (Kembayev, B.A. and Vasily-eva, N.V. (2004)) state, that countries of the European Union have a 35% share and the USA have a 25 % share.

The situation becomes clearer if the data of the Agency of Statistics of the Republic of Kazakhstan is taken into consideration, according to which 70.6% out of the total innovation products is the improved products and 25.4% is the products which has been newly adopted or sufficiently technologically modified. It means that absence of demand on the Kazakh innovation products may be explained by the low level of its novelty and consequently by its low compatibility.

Consequently, authors of this research have the following aims:

1. Study relationship between parameters of the sustainable development of the Republic of Kazakhstan and national innovation activity.
2. Develop alternative calculated indexes, which give more qualified characteristics of the national innovational activity.
3. Offer recommendations to state authorities of the Republic of Kazakhstan dealing with the innovational development of the country, analysts and tacticians in the developing countries.

2 Methodology

Study of influence of different factors of the innovational activity on sustainability of the Kazakhstan economics has been made based on the following parameters:

- Volume of the sold innovation products, million tenge (Z1)
- Share of innovation-active enterprises, % (Z2)
- Internal expenses related to research and development, million tenge (Z3)
- Expenses related to the technological innovations, million tenge (Z4)
- Number of personnel dealing with research and developments, people (Z5)
- Expenses related to science, % of the Gross domestic product (Z6)

The criterion of sustainability of the Kazakhstan economics has been represented by the index of the Gross domestic product volume (Y). The statistical correlation analysis of primary factors (with use of package of application software Statistics, Microsoft Excel) has defined the more tight relation between the dependent variable value Y and factors Z2 and Z1 (Table 3).

The presented table shows the following:

- Maximal coefficient of the pair correlation has been defined with factors Z2 (k=0.956) and Z1 (k=0.921). Taking into account the fact that the coefficient of correlation varies within the 0 and
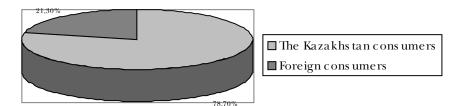

Figure 1   Volume of the innovation products manufactured in Kazakhstan for export (2006)

Table 3 Matrix of coefficients of the pair correlation between factors, functions and factors

	Z1	Z2	Z3	Z4	Z5	Z6	Y
Z1	1						
Z2	0.991	1					
Z3	0.986	0.959	1				
Z4	0.989	0.962	0.998	1			
Z5	0.983	0.954	0.985	0.994	1		
Z6	-0.013	-0.139	0.111	0.126	0.163	1	
Y	**0.921**	**0.956**	**0.877**	**0.866**	**0.833**	**-0.378**	**1**

1 ($0 \leq k \leq 1$) limits, these parameters are closer to one. The real situation shows that the more is share of innovation active enterprises in Kazakhstan, the higher are the gross domestic product of the country.

- Factors Z3, Z4 and Z5 also showed the intensive relation with the function Y, which is evidenced by the coefficients of the pair correlation, which are equal to 0.877, 0.866 and 0.833 respectively. Consequently, increase of expenses both related to technological innovation and research and elaborations lead to increase of quality and consequently increase of volume of the sold innovation products. In its turn it will lead to increase of the Gross domestic product. Analogically, the more personnel dealing with research and elaborations is, the stronger is the scientific base of the innovation system of the country, which will have the positive effect on increase of the Gross domestic product.

- Factor Z6 has the negative weak correlation with the function Y ($k = -0.378$), which will mean the non-sufficient inverse relation between the Gross domestic product and share of expenses, related to the science in the Gross domestic product. But it does not mean that the Gross domestic index does not correlate with the index of science related expenses in the absolute meaning.

3 Policy Implications and Discussion

Giving characteristics to the innovation activeness in the Republic of Kazakhstan, it is impossible to avoid the quality level of this parameter (Table 4).

Having the initial data on the industry volume, the volume of innovation products of industrial enterprises and expenses related to technological innovations of Kazakhstan enterprises, the derived index may be calculated.

Innovation capacity of the industrial products (C_I) calculated by this formula:

$$C_I = E_{TI} / V_{IND}, \tag{1}$$

where: E_{TI} - means expenses related to the technical innovations of enterprises,

V_{IND} - means volume of the industrial products.

This index describes the relation of the quantity expenses related to technological innovations per 1 tenge of the industrial product. The table 4 shows that in the year 2004, notwithstanding the absolute increase of parameter of expenses related to technological innovations in comparison with the year 2003 by 8427.2 million tenge, the relative index of the innovation capacity has decreased by 3.7%.

Relative weight of expenses related to technological innovations in the volume of the innovation products of industrial enterprises (Y_{TI}) shows the share of expenses related with the technological innovations within the innovation products themselves:

Table 4   Derivative parameters of the innovation activity of the industry of the Kazakhstan for the years 2003-2006

	Year			
	2003	**2004**	**2005**	**2006**
Volume of the industrial products[a], billion tenge	2836	3867	5253	6432
The volume of innovation products of industrial enterprises[a], million tenge	65020	74718	120408	156039
Expenses related to technological innovations[a], million tenge	26933	35360	67088	79985
Innovation capacity of the industrial products[b] (C_I), tenge/ tenge	0.00949	0.00914	0.0128	0.0124
Relative weight of expenses related to technological innovations in the volume of the innovation products of industrial enterprises[b] (Y_{TI}), %	41.40	47.30	55.70	51.30
Index of the innovation product share in the industrial products volume[b] (Y_{IP}), %	2.29	1.93	2.29	2.42
Index of the innovation return[b] (R_I), tenge/ tenge	105.37	109.41	78.12	80.64

Source: [a]The Agency on Statistics of the Republic of Kazakhstan (2007);
[b]Written by author.

$$Y_{TI} = (E_{TI} / V_I) \times 100 \ \%, \tag{2}$$

where: V_I - means volume of innovation products of industrial enterprises.

Difference of this parameter in comparison with the previous is the tighter correlation with the initial parameter of expenses related to technological innovations, i.e. change of one of them leads to the analogical change of the other one. Table 4 shoes that high relative expenses related to technological innovations in the industry will definitely lead to increase of the innovation capacity.

Index of the innovation product share in the industrial products volume (Y_{IP}) is the prime reason of changes in the index of innovation capacity of the industrial products since it is defined according to the following way:

$$Y_{IP} = (V_I / V_{IND}) \times 100\% \tag{3}$$

It means that the low innovation capacity of the industrial products or expenses related to technological innovations, per 1 tenge of the industrial products is first of all connected with the low share of the innovation products themselves in the same volume of the industrial products. Exclusion was the year 2006 in which under condition of maximally high share of innovation products in the industrial products volume (2.42%) we had decrease of the innovation capacity by 0.0004 tenge. Obviously it happened due to advance of tempos of increase of the technological innovation volume (129.5%) in comparison with tempos of increase of expenses related to technological innovations (119.2%). Index of the innovation return (R_I) or return of technological innovations, since only this type out of all the types of innovations adopted in the industry, is considered, shall be defined as the reverse index of capacity:

$$R_I = 1 / C_I, \tag{4}$$

Consequently, index of the innovation return equal to 109.41 tenge in the year 2004, reflects the maximally biggest volume of the industrial production per 1 tenge of expenses related to technological innova-

tions for the period of years 2003-2006. The economical efficiency of any enterprise including the technological modernization does not mean reduce of the most part of funds, but the maximum return from it.

Based on the abovementioned, the authors would like to offer the following recommendations to be discussed:

First, taking into accounts the surface nature of the traditionally used indexes of the innovation activity, it is important to use the additional alternative parameters, offered in this research. These criteria will allow the objective evaluation of the situation in the sphere of adoption of the innovations and timely definition of problems.

Second, taking into consideration the fact that at the present time the Kazakhstan enterprises in the sphere of the innovation activity mostly selected the 'overtaking' strategy, which supposes simulation of foreign technologies, copying of products and their mass manufacture, it is required to use the international experience in development of different purpose programs. They may be divided into two types: keeping the scientific and technical level, technologies, development, providing the evolutional transfer to the next generation of scientific and technical solutions; and updates which mean refuse from the established traditional development line, transfer to principally new technologies. They may be combined in different proportions. For example under the condition of the conservative politics, 60% of the scientific and technical potential is attracted in obtaining of the keeping aims, 35% - in development aims, 5% - in updating aims. In case of progressive politics the proportion shall look differently, i.e. like 25, 40 and 35 correspondently.

Third, occurred disproportion between elements of the chain 'research-elaborations-project-manufacturing' is negative. Over 80% out of this complex in Kazakhstan is represented by research institutions, the other is represented by design, experimental and service companies (for example, in foreign countries the proportion between scientists, designers and workers of experimental companies is equal to 1:2:4). The most part of acting research companies do not contain the engineering infrastructure, intended for materialization of scientific ideas and elaborations. Consequently, it is required to get the reasonable proportion between the components of the scientific and production process.

Fourth, in order to stimulate the national innovational activity in Kazakhstan, it is required to take measures in the state politics: like the purpose formation of the market for production of innovation enterprises by placement of the state order for them; provision of innovation enterprises including small ones with production areas, privileged investment support, assistance in development of business innovation centers, technical parks, centers of the technological supports, render of legal, financial, marketing, economical and other types of services; assistance in the process of the legal and commercial protection of the intellectual property; assistance in formation and extension of the leasing companies network; privileged crediting of scientific and technical elaborations, share financing of major projects; creation of institutional conditions for development of the venture financing.

References

The Agency on Statistics of the Republic of Kazakhstan (2007). 'Statistical Yearbook of Kazakhstan', Astana, Kazakhstan.

Balatski, E. & Lapin, V. (2004). 'Innovative sector of the industry', *The Economist* Vol. 1, pp. 20-33.

Kembayev, B.A. & Vasilyeva, N.V. (2004). 'State role in development of innovative activity in Kazakhstan', *Analytical review* Almaty, Kazakhstan.

Nazarbayev, N.A. (2007). 'New Kazakhstan in the new world', The Annual Message to the People of Kazakhstan, available at: http://www.stat.kz, accessed December 2007.