INNOVATION-DRIVEN ECONOMIC DEVELOPMENT IN LUGANSK REGION: METHODOLOGY, EVALUATION AND PROSPECTS

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Abstract: *A method to derive index of the innovation-driven economic development in a region through estimating innovativity indexes for selected indicators of the innovation process, including indicators of exports of products classified in 4th and 5th technological tenor. The method is applied to evaluate the innovation-driven development in Lugansk region in 2006–2011; it enables to identify advantages and weaknesses in the economic development of this region compared with other Ukrainian regions.*

Keywords: *innovation-driven economic development, economic innovativity, innovative products, current prices, constant prices, products classified in 4th and 5th technological tenor.*

1. INTRODUCTION

At the end of 20th century and beginning of 21st century, the capability of a country to generate and disseminate knowledge evolved into a core determinant of economic growth. With the innovation cycle growing shorter, development and dissemination of innovations has boosted the global competition. Technologically advanced and transitional economies have elaborated medium-term and long-term strategies on intensification of the innovation-driven economic development, its central resource being innovation as knowledge embodied in the commodity form. This strategy can be implemented through constructing relevant tools enabling for sound evaluation of economic development and the effectiveness of system for management and control of mechanisms and stimuli specific to innovation processes.

Review of publications. Issues of theory and practice of the innovation-driven development at country and regional level were elaborated in works of many national researchers in economics, such as A. Alimov, N. Amoshi, Yu. Bazhal, P. Bubenko, M. Butko, V. Geyets, V. Golovatyuk, Ya. Zhalilo, L. Ligonenko, Yu. Makogonov, B. Malitsky, V. Soloviyov, L. Fedulova, Yu Kharazishvili, I. Shovkun and others [1–3]. However, quite many theoretical and practical problems related with evaluation of the economic-driven development in a region are yet to be solved.

The objective of the article is to elaborate methodology for estimating index of the innovation-driven economic development in a region by calculating innovativity indexes for

selected indicators of the innovation process, to evaluate the innovation-driven economic development in Lugansk region, a large Ukrainian region, in 2006–2011 by accounting for exports of products classified in 4th and 5th technological tenors (TT), and to outline key dimensions for intensification of the innovation-driven economic development in Lugansk region.

Results. The method consists of the phases: selection of components and indicators of the innovation process; analysis of change in the indicators; measurement of indicators of the innovation process normalized as employment number and population number; calculation of innovativity indexes for each indicator, with the subsequent estimation of index of the innovation-driven development in a region.

The method includes four components of the innovation-driven development in a region. The first component characterizes financing of R&D and innovation in a region, measured by two indicators: (1) financing of R&D, per 10,000 employees, thou. UAH; and (2) total spending on innovation, per 10,000 employees, thou. UAH. The second component characterizes innovation activity at industrial enterprises, and consists of five indicators (3) share of innovating industrial enterprises; (4) number of introduced new technological process; (5) number of manufactured innovative products; (6) number of developed high technologies; (7) number of exploited high technologies, with introduction period from 1 to 5 years. The third component (three indicators) is supposed to supply performance-specific information about industrial enterprises and other economic entities in a region, by measuring their sales and exports: (8) sales of innovative products; (9) exports of innovative products; (10) exports of products classified in 4th and 5th TT (high and medium-high technologies). The fourth component (one indicator) characterizes economic performance in a region: (11) labor productivity (gross regional product (GRP) per employee), UAH.

The methodology has the following peculiarities:

1. Measurement of the innovation process indicators normalized as employment number and population number in a region allows for comparing the efficiency of the innovation-driven economic development in regions with varying numbers of population.
2. Innovativity indexes for each innovation process indicator are calculated as a share in the average value of each indicator in Ukraine, taken as 1.
3. Use of indicators of exports of products classified in 4th and 5th TT to evaluate the innovation-driven economic development in a region enables for performance evaluation at enterprise (organization) level, and at advanced high efficiency enterprises manufacturing high tech products.

A follows from the methodology, higher than average innovativity indexes derived for selected indicators are an indication of advantages in the innovation process in a region in relation to other regions, whereas lower than average innovativity indexes are an indication of weaknesses and difficulties in the innovation process in a region.

The elaborated methodology is used by the author to evaluate the innovation-driven economic development in Lugansk region, which stand out of the other Ukrainian regions by noticeable industrial capabilities covering a range of industrial sectors dominated by heavy industries, with fuel and energy complex, with the central role of mining, taking the lead. Other industries found in the region include mechanical engineering, chemical products, oil refinery, food and beverages, wood and products made thereof, textile. The

region has a noticeable number of R&D organizations and HEEs. The regional population as of 01.01.2013 was 2,256,500 people. The largest cities in the region are Lugansk, Krasny Luch, Severodonetsk, Lisichansk, Alchevsk, Stakhanov. The investment attractiveness in the region is rather high when compared with other Ukrainian regions. Thus, direct foreign investment in the Lugansk economy as of 31.12.2012 amounted to 838.5 million USD, with 12th position in the country [4], and 155 million USD in the earlier half of 2013, being 10% higher than in the analogous period of 2012.

Measures of Gross Regional Product (GRP), R&D financing, overall spending on innovation and sales of industrial innovative products for Lugansk region in 2006–2011 are shown in Table 1.

GRP in Lugansk region in 2011 amounted to 57202 million UAH (in current prices) and exceeded GRP in 2006 by 2.37, or 24159 million UAH. In 2008–2006, GRP grew by 1.78. In 2009, in the conditions of financial and economic crisis, it amounted to 38451 million UAH, which was 10.5 percent lower than in the previous year. In 2009–2011, GRP grew by 1.49. Regional employment in 2011 was 1002.2 thousand, which is 5.16 percent lower than in 2006. A key indicator of the innovation-driven economic development is scopes and tendencies of R&D and its utilization for economic purposes. In 2011, overall R&D financing in Lugansk region amounted to 161790.7 thousand UAH, or 1.69% of the total R&D financing in Ukraine (9591349.5 thousand UAH). The main sources of R&D financing in Lugansk region were central budget (14.52% of the total financing), internal funds (21.44%), funds of domestic customers (24.22%), funds from abroad (38.19%), funds of local budgets and special purpose funds (0.95%). Basically, change in R&D financing in 2006–2011 in the region corresponds with the dynamics of change in GRP (with the positive coefficient of correlation between the two variables being 0.98).

In 2011, the total financing of innovation in Lugansk region was 167.05 million UAH, or 1.68% of the total financing of innovation in Ukraine (14333.89 million UAH). Its sources were as follows: internal funds – 66.95%; central budget, local budgets and off-budget funds – 1.33%; funds of domestic investors – 9.78%; funds of foreign investors – 0%; loans – 21.94%; other sources – 0%. This distribution is noticeably different from the distribution of innovation financing in 2011 in Ukraine, with the share of financing from internal funds amounting to 59.2%, and the share of loans – 38.3%.

In 2006, the total financing of innovation in Lugansk region was 96.92 million UAH, or 1.57% of the total financing of innovation in Ukraine (6159.95 million UAH, a major share of financing being internal funds (52.54%, against 84.6% in Ukraine), foreign investors (30.48%, against 2.86% in Ukraine), loans (15.82%).

Comprehensive information about tendencies in R&D financing and innovation spending can be derived from comparisons made in current and constant prices (with use of GDP deflator) [5], to eliminate inflation effects for change in prices on commodities and services in the analyzed period (see Table 1).

As follows from the estimates in Table 1, while R&D financing in Lugansk region in 2012, measured in current prices, grew by 2.23 against 2006, the growth measured in constant prices of 2005 was only 1.13. When innovation spending is compared in comparable prices, the picture is even more negative. The year of 2011, compared with 2006, marked the decline in innovation spending by 1.37, first and foremost due to rapid decline in spending in 2011, amounting to only 61.3 million UAH in constant prices of 2005. Evaluation of R&D and innovation spending as well as decision-making regarding innovation in a

region should rest upon a central thesis from Oslo Manual, that the smaller amount of resources is allocated in innovation in macro system, the deeper is the decline in innovation capacities at enterprises within this system [6].

If measured by innovation activity, the industry of Lugansk region lagged behind other Ukrainian regions in 2006–2011. The share of innovating enterprises in the region was 13.5% (of 505 surveyed enterprises) in 2011, 11.2% (of 529 surveyed enterprises) in 2010, and 7.4% (of 609 surveyed enterprises) in 2006, against the respective shares for the Ukrainian industry being 16.2%, 13.8%, and 7.9% (see Table 1).

Although analysis of time series on innovation performance at industrial enterprises, measured by number of introduced new technological processes and number of manufactured innovative products, shows a minor increase in these categories of innovations in 2011 compared with 2006, the figures failed to reach the ones in the pre-crisis year of 2008 (see Table 1).

Table 1: Selected indicators of the innovation-driven development in Lugansk region

	2006	2007	2008	2009	2010	2011
R&D financing, million UAH (current prices)	69.7	84.7	118.0	98.1	121.1	161.8
R&D financing, million UAH (constant prices of 2005)	60.5	59.7	64.6	53.7	58.5	68.7
Total spending on innovation, million UAH (current prices)	96.9	1343.4	2178.9	111.1	243.1	167.1
Total spending on innovation, million UAH (constant prices of 2005)	84.1	947.4	1192.6	53.6	103.2	61.3
Share of innovating industrial enterprises, %	7.4	11.3	10.2	9.9	11.2	13.5
Number of introduced new technological processes	19.0	52.5	42.1	13.6	28.6	42.9
Number of manufactured innovative products	31.3	31.9	47.7	30.2	38.4	34.9
Number of developed high technologies	-	-	-	-	30.5	1.0
Number of exploited high technologies with the period of introduction from 1 to 5 years	-	-	-	-	255.1	334.3
Sales of innovative products, million UAH	3848.9	7720.3	12393.3	6158.0	6749.8	2508.9
Exports of innovative products, million UAH	2257.3	3512.9	9102.7	2930.1	2393.6	911.9
Employment, thousand persons	1054.6	1066.7	1068.8	1026.2	1015.4	1002.2
Labor productivity (GRP per employee), UAH	22908	30262	40218	37469	44850	57076
GRP, million UAH	24159	32280	42985	38451	45541	57202

Source: data from the State Statistics Service of Ukraine [7].

Also, statistical data on high technologies (advanced production technologies) and their exploitation in the region are used to evaluate the innovation-driven economic development.

Statistics of high technologies allows for conclusion about the contribution of the regional R&D capacities in the economic development, utilization of R&D results in new technological processes etc. Nearly thrice fold decline in the number of high technologies developed in Lugansk region in 2011 compared with 2010 is an evidence of the decreasing performance of R&D capacities, which may be caused by the reduced financing of innovation in 2011. Still, the increased number of high technologies exploited in the region in 2011 compared with the previous year is a very positive sign.

According to official statistical reports, the analyzed period features noticeable change in the shipment of innovative products by the regional industry. In 2011, sales of innovative produces amounted to 2508.9 million UAH, or 5.92% of the Ukrainian total, and only 2.7 % in the total sales of industrial products in Lugansk region, which is lower than the analogous figure for Ukraine (3.8%). The author believes that the industrial performance in the region, measured by exports of products classified in 4th and 5th TT and their shares in the total regional exports, has to be central to evaluation of the innovation-driven economic development in a region. Indicators measured by the author with reference to recommendations [8] on harmonization of technologies' classification by methodology adopted in the OECD for manufacturing industries, and use of data from the State Statistics Committee of Ukraine in TT context, are shown in Table 2.

Table 2: Indicators of exports of products classified in 4th and 5th TT from Lugansk region

Year	4th TT		5th TT		4th and 5th taken together	
	Amount, million USD	Share in regional exports, %	Amount, million USD	Share in regional exports, %	Amount, million USD	Share in regional exports, %
2006	585.67	19.5	31.4	1	617.07	20.5
2007	922.07	23.3	37.21	0.9	959.28	24.2
2008	1315.6	20.7	36.38	0.6	1351.98	21.3
2009	450.74	23.9	22.57	1.2	473.32	25.1
2010	978.81	29.4	27.49	0.8	1006.3	30.3
2011	1442.22	22.2	4.,43	0.7	1484.65	22.8

Source: derived by the author on the basis of data from the State Statistics Service of Ukraine

As can be seen from the figures in Table 2, due to the financial and economic crisis of 2009 exports of products in 4th TT amounted to 450.74 million USD, falling down by 2.92 compared with 2008. Still, the share of products in 4th TT grew up to 23.9% in the total exports in 2009. The period of 2010–2011 marked the increasing exports of products in 4th TT, but their share in the total regional exports fell to 22.2% in 2011, due to a slight growth in the exports of low and medium-low technologies.

Analysis of the time series on regional exports of products in 5th TT shows that in spite of their slightly increased exports up to 42.43 million USD in 2011, their share in the total regional exports fell to 0.7. Also, normalization of the selected indicators as employment

number or population number was made in accordance with the method, with calculating index of the innovation-driven economic development in the region as arithmetic average for the group of innovativity indexes, for each year. The results are given in Table 3.

As can be seen from Table 3, Lugansk region leads Ukraine by the selected innovativity indexes that are higher than the innovativity average for Ukraine. Yet, the region lags behind Ukraine by innovativity indexes 1 to 7 and 11.

Estimations of integral index of the innovation-driven economic development in Lugansk region show its slight increase in 2010 compared with 2009; economic aggravation in the region, which followed in 2011, led to a its noticeable decline (by 1.69) compared with 2010.

Table 3: Innovativity indexes for the economy of Lugansk region, 2006–2011

Indicator	2006	2007	2008	2009	2010	2011
1. R&D financing, per 10,000 employees	0.265	0.27	0.289	0.247	0.269	0.342
2. Total spending on innovation, per 10,000 employees	0.309	2.433	3.565	0.275	0.603	0.236
3. Number of introduced new technological processes, per 1,000,000 employees	0.344	0.773	0.536	0.145	0.284	0.347
4. Number of manufactured innovative products, per 1,000,000 employees	0.269	0.264	0.409	0.227	0.323	0.219
5. Number of developed high technologies, per 1,000,000 employees					1.64	0.5
6. Number of exploited high technologies with introduction period from 1 to 5 years, per 1,000,000 employees					0.828	0.9
7. Share of innovating industrial enterprises	0.661	0.796	0.785	0.773	0.812	0.833
8. Sales of innovative products, per 10,000 persons	2.433	3.772	5.338	3.886	3.992	1.186
9. Exports of innovative products, per 10,000 persons	3.445	4.703	7.603	4.403	3.479	1.446
10. Exports of products classified in 4th and 5th TT, per 10,000 persons	1.484	1.607	1.827	1.087	1.734	1.875
11. Labor productivity (GRP per employee)	0.873	0.878	0.89	0.828	0.84	0.891
12. Index of the innovation-driven economic development (without indicators 6 and 7)	1.120	1.722	2.360	1.319	1.371	0.819
13. Index of the innovation-driven economic development (with indicators 6 and 7)					1.346	0.798

Source: derived by the author on the basis of data from the State Statistics Service of Ukraine

This tendency can be explained by noticeably declined innovativity indexes in Lugansk region in 2011 for several indicators: total spending on innovation, per 10,000 employees; sales of innovative products, per 10,000 persons and exports of innovative products, per 10,000 persons. The highest index of the innovation-driven economic development in Lugansk region was derived for 2007 and 2008, due to high innovativity indexes for 8th and 9th indicators on innovation, which is caused by the established conjuncture, local (regional) and global demand for locally manufactured products, and by the increasing spending on innovation per 10,000 employees.

Considering the results from the study, primary dimensions for intensification of the innovation-driven economic development in Lugansk region, should be: revision of the regional innovation policy through prioritizing the sustained growth in the output in 5th and 6th TT, as a core factor behind significant restructuring of the regional economy and enhancing the competitiveness at both regional and country level; building up innovation infrastructure as a mix of cross-linked and interacting organizations, associations and other entities contributing to the innovation efficiency; development of tools to stimulate innovation processes in low-tech industries and other economic sectors, and to enhance the innovative focus in research institutions and HEEs; fostering of favorable innovation climate, to promote innovation projects and programs in the region, and secure their support from central and local authorities and the public.

2. CONCLUSIONS

1. The elaborated method and its application for the study of the innovation-driven economic development in Lugansk region in 2006–2011 show that the method allows for detailed by year analysis of the dynamics of index of innovation-driven economic development, with identifying advantages and weaknesses in the economic development of the region.

2. The primary dimensions in intensification of the innovation-driven economic development in Lugansk region are formulated.

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