

# ANALYSIS TOOLS OF THE RATING OF INNOVATIVE ACTIVITY ON THE EXAMPLE OF UKRAINE AND SLOVAKIA

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## Nástroje analýzy hodnotenia inovatívnej činnosti na príklade Ukrajiny a Slovenska

**Abstract:** *The current state of the economy of the country, region, enterprise is based on innovation development. In the conditions of global competition, innovations are the main source of stable development, they are the criterion of safe development. To assess the level of innovation, various methods, indicators and criteria are used by international organizations and rating agencies. At the same time, to assess the inattentiveness of enterprises, there is no single valid methodology, which, under conditions of global competition is a concern. Such ratings will allow the enterprise to identify competitors in the sphere of innovative activity in a timely manner and take the necessary managerial decisions. For the compilation of ratings, the sum method, the distance method or others can be used. This paper gives an analysis of existing methods of rating the innovation activity on the example of Ukraine and Slovakia and allows to determine the list of key indicators for compiling an enterprise innovation rating.*

**Keywords:** *innovation, innovation activity, competitiveness, rating, economic development, global economy*

**JEL Classification:** F 63, O 30

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## Introduction

Innovation is one of the main driving forces of competitiveness and economic growth. Innovation in marketing, technologies, management and other factors increase the competitiveness of the companies in global markets. Modern economy has the tends to form new criteria of competitive advantages, considering innovative processes. International practice accumulated some experience of innovative ranking of countries, regions and

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business companies. International organizations and agencies have developed different types of innovation activity ratings for countries. The ratings of innovative activity allow to follow the change in the level of inattentiveness and, accordingly, the country's competitiveness, identify problem factors and take appropriate regulatory measures.

## 1 Analysis of the rating of innovative activity

For years, researchers have developed indicators of innovation. The most famous is the European Innovation Index, which is calculated on the basis of indicators of scientific and technological development of the European Innovation Scoreboard (EIS). It is a system of indicators of scientific and technological development in Europe [2]. Indicators are formed by experts and distributed to incoming (assessed resources) and outgoing (reflecting effectiveness). They are grouped in several groups that reflect the different aspects of innovation development [3].

The ranging of countries on the basis of a comprehensive indicator determines how economic growth is based on innovation. According to the EIS, Ukraine is in the last level of of innovation in the fourth group of modest innovator with index 0.178. This group consists of Bulgaria, Macedonia and Romania. Compared with other EU countries, the backlog of Ukraine from innovation leaders about 3.5-4 times (Switzerland – 0.79, Sweden - 0.70), from strong innovators about 3-3.5 times (United Kingdom - 0.6), from the moderate innovators' countries about 2.5-3 times (Norway - 0.46) [4]. In this time, Slovakia is a moderate innovator with index 0,3501 [5].

Innovation performance of Ukraine has declined somewhat over time. Performance relative to the EU has decreased from 38% in 2008 to just above 34% in 2015. Ukraine is performing well below the average of the EU for all dimensions and on almost all indicators. The only strong relative performance is for population with completed tertiary education. The most significant relative weaknesses are in public-private scientific co-publications, community designs, community trade marks, venture capital investments. For four dimensions, performance has improved, especially for intellectual assets. The strongest growth is for community designs and license and patent revenues from abroad, and the largest declines are for non-R&D innovation expenditures and sales share of new product innovations [4].

Slovakia has the same performance as the EU. Performance in the most dimensions and the most indicators has improved. The highest growth is observed for non-EU doctorate students, community trademarks and research expenditures in the public sector. A very strong decline in performance can be observed in license and patent revenues from abroad and non-EU research and development innovation expenditures [5]. Definition and active

implementation of innovative priorities of Ukraine and Slovakia based on international strategic criteria and increasing economic competitiveness in the global and domestic markets.

Another popular rating of innovation activity is Global Innovation Index, which is a generalized indicator for measuring the level of innovation in the country in terms of GDP. It is calculated since 2007 and at the moment represents the most complete set of indicators of innovation development by different countries. In 2016-2017 Ukraine ranked the 56 position in the list of 128 countries on six positions lower than the previous year. Slovakia ranked the 37 the position [6].

Global Innovation Index composed of variables that characterize the innovative development of countries at different levels of economic development. It is a weighted sum of ratings of two groups of factors: the availability of resources and the conditions for innovation and achieved practical results of the innovation. The first subindex of innovation expenditures allows to evaluate elements of the national economy, which are divided into five main groups: institutions; human capital and research; infrastructure; the level of market and business sophistication. The second innovation subindex of results reflects actual results of such activity, results in knowledge and technology and results in creation. The final index is the ratio of costs and effects that allow to objectively evaluate the effectiveness of efforts to promote innovation in one or another country.

Considering global experience global competitiveness provides especially countries whose economies are based on high technologies and innovations, effective market institutions and regulatory business environment. According the calculating of index [7], having regard to the development of economic parameters such as institutions, infrastructure, macroeconomy, health, education, market efficiency, technological equipment, business environment and innovation, Ukraine ranked 85 th position out of 138 countries in 2016 [7]. In 2012 Ukraine ranked on the 73th position, in 2013 on 84th position, in 2014 on 76th position and in 2015 on the 79th position. That Ukraine over the last year in the ranking of global competitiveness lost 6 positions. The fall of Ukraine's rating is due to the low productivity of the economy and other factors. But it is not consistent potential of the country. Ukraine's position between Namibia and Greece shows that the introduction of innovative processes related to certain problems. Slovak's position in Global Competitiveness Index 2016-17, where the country ranked 65<sup>th</sup> [7]. We consider a fragment of the rating in innovation in 2016-2017 years in Table 1.

Table 1

## Comparison of rating indicators in 2016-2017 (fragment) [7]

Performance	Ukraine	Namibia	Greece	Slovakia	Switzerland
	85 places	84 places	86 places	65 places	1 place
Capacity for innovation	49	71	96	61	1
Quality of scientific research institutions	50	92	67	62	1
Company spending on R&D	68	51	90	64	1
University-industry collaboration in R&D	57	89	124	82	1
Gov't procurement of advanced tech. products	82	58	121	76	28
Availability of scientists and engineers	29	105	10	90	14
PCT patent applications applications/million pop	49	92	38	37	3
Property rights	131	34	89	79	1
Intellectual property protection	125	40	61	54	1
Diversion of public funds	120	58	80	122	8
Judicial independence	129	30	69	120	4
Efficiency of legal framework in settling disputes	121	33	130	137	3
Efficiency of legal framework in challenging regs	126	25	84	133	1
Business costs of terrorism	128	14	63	31	26
Business costs of crime and violence	116	90	52	62	16
Organized crime	124	60	50	74	17
Strength of auditing and reporting standards	129	33	105	27	6
Efficacy of corporate boards	121	65	105	45	8
Protection of minority shareholders' interests	136	63	84	99	19
Inflation annual % change	136	60	92	70	94
Tertiary education enrollment rate gross %	11	118	1	54	47
Effectiveness of anti-monopoly policy	136	48	97	86	13
Effect of taxation on incentives to invest	133	30	136	94	7
No. of procedures to start a business	22	116	41	54	54
Business impact of rules on FDI	130	77	113	17	12
Burden of customs procedures	130	57	71	54	14
Firm-level technology absorption	74	66	73	42	1
Domestic market size index	48	115	51	67	39
Foreign market size index	38	112	60	41	29
Exports % GDP	27	54	84	10	24
State of cluster development	125	73	117	51	14

Source: processed by [7].

According to some key indicators and factors of innovation [7], Ukraine occupies one of the last places. These include property rights, intellectual property protection, efficiency of legal framework in challenging regs, strength of auditing and reporting standards, protection of minority shareholders'

interests, inflation annual % change, effectiveness of anti-monopoly policy, effect of taxation on incentives to invest, business impact of rules on FDI, burden of customs procedures, state of cluster development. These are the ones indicators that primarily constrain innovative processes of Ukrainian enterprises. High places of Ukraine on indicators such as availability of scientists and engineers, tertiary education enrollment rate gross, No. of procedures to start a business, exports % GDP indicate that Ukraine is not carried reorientation of government policy on the use of scientific knowledge as a major resource for economic growth as it is observed in developed countries as Sweden, Japan, Germany, USA, Finland, of Denmark, and Switzerland. Slovakia in the ranking rose from 67 positions in 2015-16 to 65 positions in 2016-17. The problematic positions of Slovakia are diversion of public funds, efficiency of legal framework in settling disputes, efficiency of legal framework in challenging regs, judicial independence. One of the best position is exports % GDP. Thus, the most problematic factors for doing business in Slovakia are corruption, tax rates, inefficient government bureaucracy, tax regulations and others.

According to some criteria, Ukraine's indicators are higher than those of Slovakia, some are lower. The problematic factors in order to initiate the development of business in both countries are almost identical.

The international agency Bloomberg Rankings conducts the rating of innovative countries. The methodology used by Bloomberg, involves analysis of seven factors. The international agency Bloomberg selected countries which satisfy at least five of these factors in the prescribed percentage. Let's consider the factors which, Bloomberg analyzes as the innovation. Firstly the intensity of research and development studied (20%) as the percentage in GDP growth. Then the performance (20%) as a GDP per employed person per hour; high-tech density (20%) as a percent of the total number of public companies; the concentration of researchers (20%) as a concentration of researchers and developers per million people. The agency also analyzes a technological capabilities (10%) as a percentage of manufacturing in GDP and the share of high-tech products for export; a tertial efficiency (5%) as a coverage ratio of university graduates; a patent activity (5%) as the share of patent applications per million of population. In the ranking of the 50 most innovative countries in the world by Bloomberg in 2017, Slovakia ranked 36 position and Ukraine ranked in the 42<sup>nd</sup> position, ahead of Serbia, Thailand, Tunisia, Brazil, Cyprus, Kazakhstan, Argentina, Morocco. First place was taken by South Korea, Sweden was second, Germany closed the top three. Switzerland and Finland got into top five [16].

Ukraine revealed the following results as the intensity in research and development was 44 position, manufacturing value-add were 47<sup>th</sup> position,

productivity was 50 position, High-tech density was 34<sup>th</sup> position, concentration of researchers was 4<sup>th</sup> position, tertiary efficiency was 44 position, and the patent activity was 27<sup>th</sup> position [16]. The strongest parties of Ukraine were concentration of researchers and patent activity. The weaknesses were performance and technological features. Slovakia revealed the following results as the intensity in research and development was 36<sup>th</sup> position, manufacturing value-add were 10 position, productivity was 24<sup>th</sup> position, concentration of researchers was 29<sup>th</sup> position, tertiary efficiency was 40 position, and the patent activity was 44<sup>th</sup> position. According to the positions of Slovakia, comparatively low indicator of patent activity compared with Ukraine, although the indicators of manufacturing value-add and productivity have high ratings.

For listed the data (Table. 2) on the portal Ukrstat [10] and Slovstat [11], the number of organizations that perform research in Ukraine and the number of scientists since 2005 gradually reduced and in Slovakia the number of enterprises which innovation activity increased.

Table 2

**Research staff and number of scientific organizations in Ukraine and Slovakia [10-11]**

Year	Number of enterprises which innovation activity		The number of scientists, persons	
	Ukraine	Slovakia	Ukraine	Slovakia
2000	1490		120773	22256
2001	1479	1214	113341	21997
2002	1477		107447	21025
2003	1487	1108	104841	20928
2004	1505	1459	106603	22217
2005	1510		105512	22294
2006	1452	1635	100245	23120
2007	1404		96820	23437
2008	1378	3494	94138	23641
2009	1340		92403	25388
2010	1303	2106	89564	28128
2011	1255		84969	28596
2012	1208	2302	82032	28880
2013	1143		77853	27823
2014	999	2432	69404	28825
2015	978		63864	28752

Source: processed by [10-11]

Table 2 demonstrates the reduction in innovation activity in Ukraine and Slovakia. The reasons for reducing the number of research should be considered primarily a reduction of financing volumes, and the reason for reducing the number of scientists - material support of workers, causing brain drain from the country and regions. Despite the decline, Ukrainian companies continue to perform development and innovation, it is primarily the IT sector, agriculture (due to the favorable climate and the fate of exports), defense industry (because of fighting in the east), mechanical engineering, metallurgy and chemical industry (through sustainable structure of export products of these industries). The innovations implementation in these enterprises creates demand for research and development in the country and increase the competitiveness of Ukraine in foreign markets. The number of scientists in Ukraine has declined catastrophically since 2000, while in Slovakia it is gradually increasing. Slovak companies can innovate in a form of buying machinery, equipment and software. Slovak firms are facing numerous barriers constraining optimal execution of innovation activities as market factors, lack of demand or deficit of important information.

The direction of Ukraine and Slovakia for the implementation of model of economic growth through the use of mechanisms of innovative development, improvement of organizational and economic mechanism of innovation should contribute intensive development of market economy, to ensure acceleration of implementation in production of the latest achievements of science and technology, better satisfy customers in a variety of high quality products and services.

## **2 Innovation rating of the company**

To justification and adjustment of perspective areas of industrial development should be performed evaluating innovation activity by ranking. Nowadays we have not the common methodology for assessing innovation activity [1, 12, 15]. Determination of the dynamics of rating indicators will change or clarify their forecasts for further development based on changes in business, financial and economic conditions [8-9]. At the enterprise the innovations act as the instrument of manufacturing, development and, the existence of the business.

The Boston Consulting Group identified the top 50 innovative corporations. The main factors considered in this research are: research activity of corporation, technological production development, corporate competence in the field of innovation, prospects for expanding production, innovative business models which are favorable to the introduction of and corporate culture level [14]. Table. 3 shows the rating of the most innovative corporations in the world in 2016.

Table 3

**Top of innovative companies in the world in 2016 (detail) [15]**

Rating	Corporation	Rating	Corporation
1	Apple	11	Bayer
2	Google	12	Southwest Airlines
3	Tesla Motors	13	Hewlett-Packard
4	Microsoft	14	BMW
5	Amazon	15	General Electric
6	Netflix	16	Daimler
7	Samsung Group	17	Uber
8	Toyota	18	Dupont
9	Facebook	19	Dow Chemical Company
10	IBM	20	BASF

Source: [14].

Thus, the list of BCG-2016 of the 50 most innovative companies underlines the effective impact of the digital revolution. The main technological giants receive their leading position not the first time. First position in the ranking of the most innovative corporations ranked American corporation Apple, whose products are known throughout the world. Each of the goods of the corporation is an innovative technology. On second position was Google, which primarily operates in the field of information retrieval on the Internet, the development of Internet services and online advertising. Google Inc. continuously improves its products and engaged in development of original innovation. On the third position in terms of high-tech innovation was a Tesla Motors, which launched a series of electric vehicles. In the field of automotive industry of innovative leading included Tesla, Toyota, BMW, Daimler, General Motors, Renault and Honda. In the retail trade in the top 50 was only five corporations as Amazon, Netflix, Under Armour, Nike, Procter & Gamble. In the field of industrial production we can see General Electric, DuPont, Dow Chemical, BASF, SpaceX, 3M and Siemens. In the field of technology and telephony we can present Apple, Google, Microsoft, Samsung, Facebook, IBM, Hewlett-Packard, Cisco Systems, Xiaomi, NTT Docomo, Intel, Dell, Orange, Huawei, BT Group [14]. The subsections of some corporations working in Ukraine.

The competitiveness of business entities defined by their innovation. The special features of innovative competition include the high dynamic market; cost of goods or services is determined by their novelty, originality, uniqueness and modernity; competition is intense changes in the organizational structure, policy management; subjective factor plays an important role in creating competitive advantages and implementation of competition policy of the company. Formation of competitive advantages based on innovations can be achieved only through their implementation, the implementation of new



products and the use of new technologies. This brings enterprises to a new technological level, providing superiority to competitors, on the basis of which competitive advantages are formed. The sequence of “knowledge - innovation - technological superiority - competitive advantages - strategy and strategic management of the company - success in global competition” explains the current stages of success in global competition, justifies the importance of knowledge and innovation in competition, inextricably links knowledge management, innovation, technology and strategic management.

The determination of innovative position in global competition is possible with the rating. The object of rating research can be an individual enterprise, type of economic activity, industry or sector of the economy as a whole. For a comprehensive evaluation of innovation enterprises and regions should use economic and mathematical methods, the method of sums, and the distance method. The set of indicators for research fluctuates. These indicators include the volume of shipped innovative products (A1); share of innovative products in the total volume shipped (a2); products, which has undergone significant technological change and improvement (a3); introduction of new technological processes and waste-saving technologies (A4); development of new types of machinery, equipment, apparatus, instruments, materials, products (A5); the share of industrial enterprises that implemented innovations (A6); the share of products of organizations that carried out technological innovations in the total volume of exports of products (A7); the intensity of expenditure on technological innovation (A8) and the others (As).

Ratings fix statistical situation and predict the possible future direction rating change. By the sum method, the integral indicator of innovation is calculated from the sum of the ratios of the indicators (A1...As). By the distance method, a certain reference object is selected and further in the exponent space the distance between this object and the evaluated object.

The company Forbes Ukraine, in turn, developed and introduced the rating of Ukrainian innovative companies, which was based on a survey, which was attended by experts who evaluated the level of unique products and business processes. For evaluation of innovative corporations Ukrainian experts considered the uniqueness of products and innovation in technologies, and the uniqueness of the business processes of the corporation, the extent of innovation of the corporation, the presence of corporate competitive advantage through innovation, the desire of competitors to copy innovation, of the corporation contributions to the development of innovation [13]. The three leaders of Ukrainian innovators in the fields of marketing, product innovation and management include Privatbank, “Yuzhmash”, and “Nova poshta”.

## Summary

On the basis of ratings we can make innovative models that will complexly evaluate and substantiate innovative regulatory policy on activation of innovation processes. Thus, the role of innovations in global competition lies in the fact that they provide opportunities for companies carrying out innovative activities, through their implementation, to ensure technological dominance in the market and victory in competition, provided a properly formed strategy. This paper analyzes the current situation of rating of innovation activity and examines the innovation development of Ukraine and Slovakia. The aim of this study was to analyze the performance of rating analysis and take a proposition for innovation rating of company. The direction of further research is the construction of ratings of inattentiveness of enterprises in Ukraine and Slovakia in order to determine the level of their competitiveness.

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