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ANALYZING UKRAINE'S RANKING IN MAJOR INTERNATIONAL KNOWLEDGE ECONOMY INDEXES

Key role of innovative activity for strengthening state's competitive position in the context of Knowledge Economy is justified. Major international rating systems for measuring Knowledge Economy Index are reviewed. Results of computation of Knowledge Economy Index and Index of Ukrainian economy innovation are systematized. Conditions determined for innovative development of Ukrainian in the context of knowledge economy.

Keywords: knowledge economy, innovation, index, international rating, valuation.

Калюжна Н.Г. АНАЛІЗ ПОЗИЦІЙ УКРАЇНИ У МІЖНАРОДНИХ РЕЙТИНГАХ ІННОВАЦІЙНОСТІ ДЕРЖАВ

У статті обґрунтовано ключову роль інноваційної активності у зміцненні конкурентних позицій держави в умовах економіки знань. Розглянуто основні міжнародні рейтингові системи вимірювання індексу економіки знань. Систематизовано результати розрахунку індексів економіки знань та інноваційності економіки України. Визначено передумови інноваційного розвитку України в умовах економіки знань.

Ключові слова: економіка знань, інноваційність, індекс, міжнародний рейтинг, оцінка.

Калюжная Н.Г. АНАЛИЗ ПОЗИЦИИ УКРАИНЫ В МЕЖДУНАРОДНЫХ РЕЙТИНГАХ ИННОВАЦИОННОСТИ ГОСУДАРСТВ

В статье обоснована ключевая роль инновационной активности в укреплении конкурентных позиций государства в условиях экономики знаний. Рассмотрены основные международные рейтинговые системы измерения индекса экономики знаний. Систематизированы результаты расчета индексов экономики знаний и инновационности экономики Украины. Определены предпосылки инновационного развития Украины в условиях экономики знаний.

Ключевые слова: экономика знаний, инновационность, индекс, международный рейтинг, оценка.

Problem statement. Crucial factor for gaining economic independence and strengthening state's competitive position at the international markets in the context of knowledge economy is innovation activity of the country's business entities. Measuring innovation by means of estimation a system of relevant factors contributes to the effectiveness estimate of state's participation in global innovative processes and serves as major condition for adequate strategy for innovative development at the national as well as enterprise level as separate business units.

Ukraine's commitment in advancement towards knowledge economy assumes utilization of proper measurement techniques of the knowledge economy index, which would contribute to the formation of an adequate valuation Ukraine's rating compared to other countries and its promotion towards the knowledge society and knowledge economy.

Scientific research and publications analysis. Lately challenges and prospects for further development of the knowledge economy become the subject of active scientific research for both local [1, 8], and international [5, 7] scientists. This is stipulated by the fact that at the present stage of the world economic system development, the formation of the knowledge economy (knowledge and innovation economy) in most countries is viewed as a vital prerequisite for economy growth. As a result arises necessity for measuring countries' innovation development. Different methodologies based on ranking countries by a certain characteristic (index) exist for this purpose.

Goal of the article. Identification and analysis of Ukraine's position in international innovation ratings will contribute to determining prerequisites for Ukraine's advancement to the knowledge economy.

Material presentation. At present time, several methodologies for knowledge economy index calculation exist. These methodologies employ different factors and indicators. We shall review those methodologies based on which Ukraine is evaluated.

Thus, methodology for measuring Global Knowledge Economy Index (GKEI), proposed by the United Nations Economic Commission for Europe (UNECE) [13] and researched by L.I. Fedulova [8] is based on the computation of three indexes:

TI – technological index (includes the following components: access to computer networks; internet education; internet community; internet economics; innovations);

SII – state-institutional index (calculated as normalized quantity of state on-line web sites);

MEI – index of macroeconomic environment (calculated as normalized value of GDP of per capital).

Global Knowledge Economy Index has the following formula:

$$GKEI = A_{TI} + B_{SII} + C_{MEI}, \quad (1)$$

where A, B, C – weight coefficients; $A+B+C=1$.

Table 1 demonstrates computed values of the Global Knowledge Economy Index for Ukraine and other CIS countries. Thus according to the UNECE methodology, Ukraine with its GKEI value of 0.0607 is lagging behind such countries as Russia ($GKEI = 0.164$), Baltic states and even Byelorussia ($GKEI = 0.0652$). Such a low value of GKEI Ukraine received because of inadequate level of GDP per capita.

Methodology for the Knowledge Economy estimation developed by the World Bank [10, 11], includes 76 structural and quantitative variables (from 0 to 10), including 14 base variables broken down into four Knowledge Economy pillars: Economic Incentive and Institutional Regime, Human Resources (Level of Education, Innovation, and Information and Communications Technologies. Variables are normalized on a scale of 0 to 10 relative to other countries in the comparison group. This methodology is the founding base for the Knowledge for Development Program (K4D) developed for the Organization for Economic Co-operation and Development (OECD) member countries. K4D Program calculates two aggregated indexes [8]:

Table 1
Global Knowledge Economy Index
values for selected countries

Country	Technological index (TI)	State-institutional index (SI)	Index of macroeconomic environment (MEI)	Global Knowledge Economy Index (GKEI)
USA	1.00	1.00	1.00	1.00
Russia	0.362	0.125	0.0472	0.164
Estonia	0.274	0.124	0.054	0.160
Lithuania	0.249	0.0568	0.0840	0.135
Poland	0.116	0.135	0.113	0.118
Latvia	0.154	0.0652	0.0810	0.103
Byelorussia	0.152	0.0193	0.0225	0.0652
Ukraine	0.139	0.0362	0.0168	0.0607
Kazakhstan	0.0635	0.0205	0.0269	0.0381
Moldova	0.0258	0.0144	0.00812	0.0151

According to: [8, p. 471]

Knowledge Economy Index (KEI). The KEI is calculated based on the average of the normalized performance scores of a country on all Knowledge Economy pillars: economic incentive and institutional regime, education and human resources, the innovation system and information and communication technology (ICT);

Knowledge Index (KI). Methodologically, the KI is the simple average of the normalized performance scores of a country on the key variables in three Knowledge Economy pillars – education and human resources, the innovation system and information and communication technology (ICT).

It is virtually impossible to calculate KEI and KI for Ukraine in accordance with the methodology established by the World Bank due to the lack of important statistical data. At the same time, based on some indirect data the World Bank granted Ukraine the 21-th place out of 30 countries. Ukraine demonstrates weak performance in three out of four Knowledge Economy pillars: economic incentive and institutional regime (place 21), the innovation system (place 19) and information and communication technology (place 25) [8]. Also according to the Integration Index of economy innovation Ukraine scores 5.7 out of 10 [3]. This index is based on the valuation of four components: education, innovations, information technologies and institutional regime. Despite Ukraine's low score of the Integration Index, it's worth noting that the country has a competitive edge in the high level of population's education. Thus according to the indicator "population's literacy for age 15 and older", Ukraine has 99.6%, "secondary education"–93.0%; "higher education"–42.0% [6]. The above mentioned statistics mean that Ukraine has educated and highly qualified population which under favorable conditions can become a powerful driver for innovations.

Let's discuss International Innovation Index [9] (III) which results can be of great interest. III is measuring the level of innovation of a country, produced jointly by The Boston Consulting Group (BCG), the National Association of Manufacturers (NAM), and The Manufacturing Institute (MI), the NAM's nonpartisan research affiliate. III is a part of a large research study that looked at both the business outcomes of innovation and government's ability to encourage and support innovation through public policy. To rank the countries, the study measured both innovation inputs

and outputs. Innovation inputs included government and fiscal policy, education policy and the innovation environment. Outputs included patents, technology transfer, and other R&D results; business performance, such as labor productivity and total shareholder returns; and the impact of innovation on business migration and economic growth. The study comprised a survey of more than 1,000 senior executives from NAM member companies across all industries; in-depth interviews with 30 of the executives; and a comparison of the "innovation friendliness" of 110 countries and all 50 U.S. states. Ukraine holds the 64-th place in GII rating with negative score of -0.45.

Table 2
International Innovation Index
values for selected countries

Rank	Country	Total Score	Innovation Inputs	Innovation Performance
1	Singapore	2.45	2.74	1.92
2	South Korea	2.26	1.75	2.55
3	Switzerland	2.23	1.51	2.74
8	USA	1.8	1.28	2.16
49	Russia	-0.09	-0.02	-0.16
63	Panama	-0.43	-0.48	-0.34
64	Ukraine	-0.45	-0.13	-0.73
65	Egypt	-0.47	-0.46	-0.43
110	Zimbabwe	-1.63	-1.63	-1.48

Composed based on data [9]

Also Ukraine scores rather low in The Global Innovation index (Table 3) – INSEAD version. The Global Innovation index – is a global by country research measuring innovations development conducted by international business school INSEAD (France). This index is published in a form of annual publication since 2007 and at present time comprises one of the most complete valuation of innovation development by country [2]. GII a composite indicator based on 80 basic indicators. It that ranks countries in terms of their enabling environment to innovation and their innovation outputs. GII relies on two sub-indices, the Innovation Input Sub-Index and the Innovation Output Sub-Index, each built around key pillars:

1. Innovation Input. Five input pillars capture elements of the national economy that enable innovative activities: Institutions, Human capital and research, Infrastructure, Market sophistication, and Business sophistication.

Table 3
Global Innovation Index 2015 (INSEAD)
values for selected countries

Ranking	Country	Value of Global Index of innovations
1	Switzerland	68,30
2	United Kingdom	67,42
3	Sweden	62,40
5	United States of America	60,10
48	Russian Federation	39,32
63	Serbia	36,47
64	Ukraine	36,45
65	Seychelles	36,44
141	Sudan	14,95

Based on data [2]

Table 4

Aggregated information on Ukraine's Knowledge Economy and Innovations valuation

Methodology	Ukraine's rating	No. of countries	Aggregated indicators of valuation	
Knowledge Economy index (World Bank)	21	30	Economic Incentive and Institutional Regime, Education, Innovation, and Information and Communications Technologies	
Global Innovation index (BCG, NAM)	64	110	Innovation inputs	Government and fiscal policy, education policy and the innovation environment.
			Innovation outputs	Patents, technology transfer, and other R&D results; business performance, such as labor productivity and total shareholder returns; and the impact of innovation on business migration and economic growth
Global Innovation Index (INSEAD)	64	141	Innovation Input Sub-Index	Institutions, Human capital and research, Infrastructure, Market sophistication, and Business sophistication
			Innovation Output Sub-Index	Knowledge and technology outputs and Creative outputs

Aggregated by the author

2. Innovation Output. Two output pillars capture actual evidence of innovation outputs: Knowledge and technology outputs and Creative outputs.

Thus, the final GII score for the country is a relation of efforts and subsequent effect, which allows to conduct objective valuation whether innovation development efforts were effective for each given country.

As displayed in Table 3, out of 141 ranked in GII, Ukraine holds 64-rd place with final score of 36.45. It is worth noting that regardless of the methodology used for computing GII, the list of best performing countries was virtually the same.

Based on GII analysis provided in research [4, c. 17], Ukraine has the following strengths: level of higher and secondary education, knowledge absorption by businesses, knowledge creation (intangible assets). At the same time, Ukraine's weaknesses in the context of innovations development are regulatory environment, capitalization of businesses, cluster development (integrative connections between education, science and production).

Knowledge Economy and Innovation Indexes' computation results additionally systematized in Table 4 allow to figure out Ukraine's strengths and weaknesses in the context of provision its innovation development with the purpose of further advancement toward the knowledge economy. Thus, we can conclude that the current state and the tendency for further development of Ukraine's innovation potential are not satisfactory. Ukraine scores relatively well in such prerequisites for innovation development as human capital, level of higher, secondary and professional education, science. At the same time Ukraine's low scores in GII for integrative connections between education, science and production, signal about the low level of knowledge utilization by businesses from the standpoint of entities involved in innovation activity. Also, Ukraine's scores obtained from GII and KEI signal about the absence of institutional prerequisites for knowledge economy development and implementation of businesses' innovation potential in Ukraine.

Thus, creation of favorable institutional prerequisites for formation effective integrative connections between education science and production should be considered the top priority directions in Ukraine's state policy. One of the organizational prerequisites for solving this task is innovations clusters formation, which is a system of close interconnection between scientific and educational institutions, business, society and governmental bodies. This system included the whole innovation chain from scientific idea emergence all the way to its implementation with the purpose of support and

development business entities' innovation activity in the context of knowledge economy. Since production and prompt innovations implementation at the current phase of world economic system development are the major tools for improving country's competitiveness at the international markets, formation of innovation clusters should contribute to Ukraine's advancement to the knowledge economy and its entry onto the new level of international economic relations.

Summary. Analyzing Ukraine's ranking in major international Knowledge Economy indexes is a prerequisite for determining priority vectors of innovation development and driving forces for the country's economic growth.

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