MACROECONOMIC FACTORS OF INCREASING THE RANKING IN THE GLOBAL INNOVATION INDEX

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A B S T R A C T	K E Y W O R D S
The article examines the macroeconomic factors for improving the rating in the Global Innovation Index (GII), in particular, based on the analysis of the methodological framework, groups data sources and macroeconomic indicators of the GII, and identifies quantitative indicators of the index..	Global Innovation Index, rating, cost sub-index, results sub-index, indicators, indicators, ratio, macroeconomics.

Introduction:

In the process of transition from an industrial society to a knowledge economy society, innovation and innovative activity is a key factor in competitive advantage. It can manifest itself both in the ability of firms, regions and countries to adapt to new constraints, as well as in their willingness to seize new opportunities. To realize the social potential, the innovation policies of countries should promote renewal in all sectors of the economy, and not just focus on high-tech industries. Therefore, scientists and experts are faced with the task of identifying new ways and methods that allow all parts of the economic system to be adapted to each other, to build their dialogue that can unlock the country's innovative potential[1].

Materials and Methods

Research in the field of innovation theory is carried out at three levels: macro-, meso- and micro-. At the macro level, mainly the issues of the impact of innovation on economic growth are considered, the main attention is directed to the problems and prospects for the development and diffusion of innovations in countries[2].

Meso-level research is concentrated in the field of relations between firms, research institutes and government bodies, here the mechanisms of the functioning of the national innovation system are investigated. Through the norms and rules fixed by legal, tax, financial institutions, including

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[1] Kirdina-Chandler S.G., Deryabina M.A. Mesoeconomics: state and prospects / Monograph. 2018. P.234.
[2] Taylor M.Z. (2016). The Politics of Innovation. Why some countries are better than other at Science and Technology. Oxford: Oxford University Press.

innovation support institutions, the integration and coordination of the efforts of the main participants in this activity is ensured.

The micro level refers to the dynamics of innovation within firms and organizations. Here, research is related to the search for ways for the emergence and development of innovations by economic entities, the creation of an innovative climate in organizations, etc.[3].

The Global Innovation Index (GII) is an annual ranking and analytical review of more than 130 countries and territories in the field of innovation, which has been conducted since 2007 by the INSEAD business school, the World Intellectual Property Organization and Cornell University (USA).

The index ranks countries and territories in terms of annual innovation performance by region and income group. The index makes it possible to assess the quality and effectiveness of institutions, the state of innovation or changes in the business environment. Entry and improvement in such indices is necessary for any developing country, since independent indicators are barometers of the country's socio-economic development, and are also often taken into account by large international investors when deciding to invest in the economy of a particular developing country[4].

GII has a close positive relationship with the level of economic development of countries and the rate of economic growth. On the one hand, more developed countries have more economic leverage to stimulate innovation, but on the other hand, macroeconomic research shows that innovation is a fundamental driver of economic growth[5].

However, the GII is not a definitive ranking that evaluates innovative development. Assessing the results of innovation activity remains difficult, so much attention is paid to assessing the climate and infrastructure for innovation.

GII methodology. The GII methodology is based on over 130 country/economy profiles, including data, rankings, strengths and weaknesses 80 data tables for indicators from over 30 international public and private sources, of which 57 are hard data, 18 composite indicators and 5 questions for surveys. All GII calculations based on this methodology are annually verified by the Joint Research Center (JRC) of the European Commission[6].

While the outcomes are based on multiple rankings, the GII focuses more on improving "ways" to improve measurement of innovation and identifying targeted policies, best practices, and other levers that drive innovation. Likewise, an advanced data scorecard by index, sub-index, or indicator level can be used to monitor performance over time and compare developments to economies in the same region or by income group classification.

The annual GII ranking builds on previous rankings, allowing countries to track the progress of their ongoing reforms to build an innovative economy.

The calculation methodology is based on the analysis of factors influencing annual changes in the GII ratings and is calculated as the arithmetic mean of two groups of indicators - sub-indices: contributions

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[3] McGrath R. (2010). Innovation is Equal Parts Politics and News Ideas // Harvard Business Review. hbr.org/2010/06/innovation-its-as-muchabout-p.html.

[4] Salakhodzhaev R. Why should Uzbekistan improve its position in the Global Innovation Index.https://cabar.asia/ru/pochemu-uzbekistanu-stoit-uluchshit-pozitsii-v-globalnom-innovatsionnom-indekse

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[6] The Joint Research Center (JRC) is the science and knowledge service of the European Commission, which employs scientists to conduct research in order to provide independent scientific advice and support for EU policy. https://ec.europa.eu/jrc/en

to the development of innovation - the sub-index of costs (Innovation input) and practical results in the development of innovation - the sub-index of results (Innovation output) (Figure -1).

The sub-index of costs (Innovation input) measures the elements of the national economy that embody innovation activity, grouped into five components: 1. institutions; 2. human capital and research; 3. infrastructure; 4. market development; 5. business development.

The innovation output sub-index reflects the performance of innovations divided into two components: 6. results in the field of knowledge and technology; 7. results of creativity.

The report ranks countries/economies and scores them on a 100-point basis with appropriate ranking positions, i.e., 80 indicators are normalized in the range of 0-100 points (high scores represent better results) based on a maximum and minimum value method (excluding indicators in surveys and other international indices, in which the initial data are presented in the range of minimum and maximum values). In particular, the UNPAN (0.1), World Economic Forum Executive Opinion Survey (1.7) and World Governance Indicators (0.100) indicators.

For indicators where the value grows with the highest scores, the formula (goods) is applied:

$$\text{Goods: } \frac{\text{economy value} - \text{Min}}{\text{Max} - \text{Min}} \times 100$$

For indicators where the value grows with low scores, the formula (bads) is applied:

$$\text{Bads: } \frac{\text{Max} - \text{economy value}}{\text{Max} - \text{Min}} \times 100$$

4 indicators of the GII rating are included in the Doing business index (World Bank), 4 indicators - the Global Competitiveness Index (WEF), 4 indicators - Worldwide Governance Indicators, 1 indicator - the Electronic government (E-government survey, UN).

To provide a complete picture of macroeconomic indicators and compare countries by level of innovative development, data from various sources (provided by international organizations and financial institutions) are used with various base years available. The data in the GII are normalized using the GDP or population of a country for cross-country comparisons.

To assess countries in the GII ranking, there is a minimum data coverage (at least 35 indicators in the group of contributions to innovation development - 66%, at least 18 indicators in the group of results in innovation development - 66%). At the same time, indicators with missing data are not taken into account in the calculations, i.e., the lack of data for countries affects the index estimates of other countries. Outliers are defined by skewness or kurtosis (skewness factors greater than 2.25 or kurtosis greater than 3.5). The following formula is used to fix the drop-down data issue:

$$\ln\left[\frac{(\text{Max} \times f - 1)(\text{economy value} - \text{Min})}{\text{Max} - \text{Min}} + 1\right]^{13}$$

Where:
max is the maximum value in the data series;
min is the minimum value in the data series.

Research results. The GII consists of 7 main areas: management institutions; human capital and research; infrastructure; market development; business development; knowledge and technology outcomes; creative results. These directions are based on 21 structural sub-blocks (Figure-1).

Picture 1. Main directions
Global Innovation Index (GII)[7]
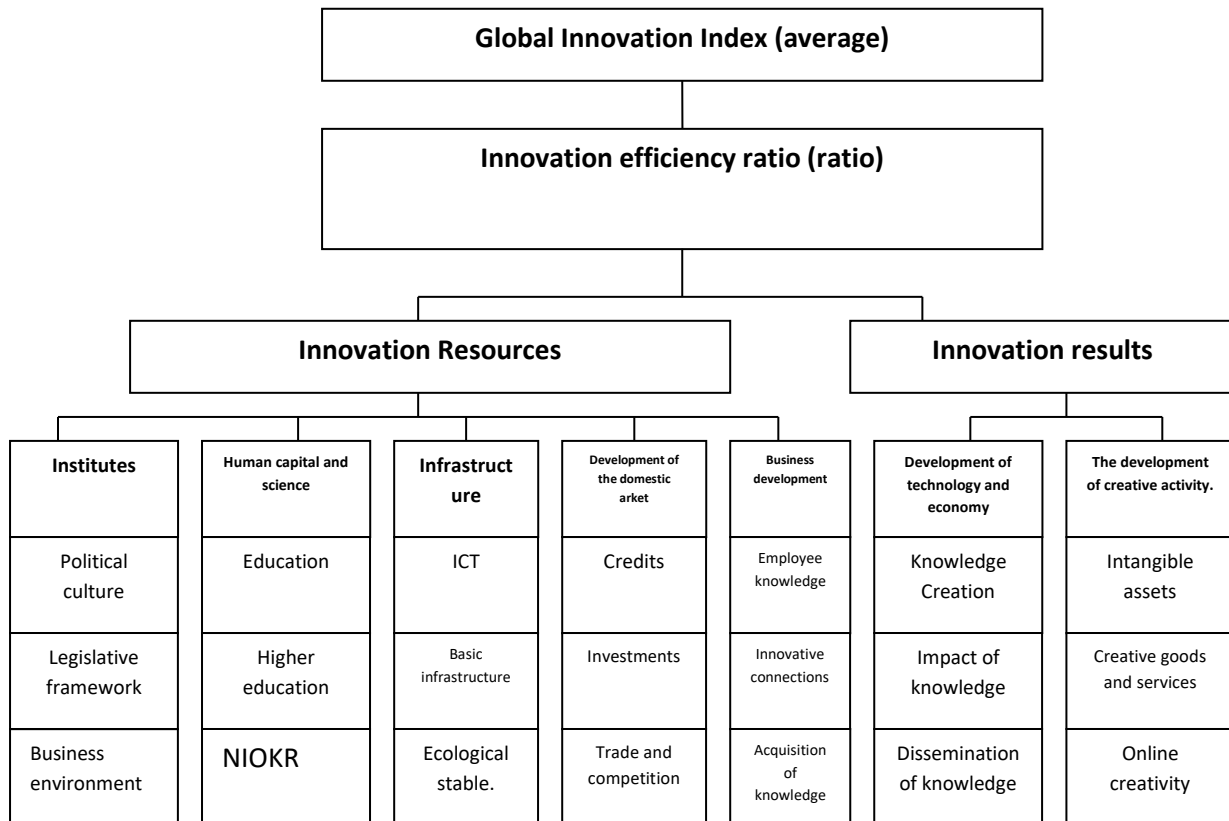
Table 2 Elements
Global Innovation Index [8]

composite element	Значение	Position
Index	Arithmetic mean of sub-indices	The position among all countries is calculated based on the values
Subindex	Each sub-index is calculated as the arithmetic mean of the constituent blocks	
Blocks	Each block is calculated as the arithmetic mean of the composite subblocks (each subblock has a coefficient)	
Subblocks	Each block is calculated as the arithmetic mean of composite indicators (each indicator has a coefficient)	
Indicators	Each indicator has a separate calculation formula and is given a score from 0 to 100 based on the values obtained. The country with the lowest score gets 0 and the country with the highest score gets 100	

[7] "The Global Innovation Index 2015". R.9.

[8] The Global Innovation Index (GII) is the position of the Republic of Uzbekistan in the ranking. Ministry of Innovative Development of the Republic of Uzbekistan. T. 2020. P.7.

Indicators of 21 structural sub-blocks are formed on the basis of the results of 80 indicators that cover the areas of socio-economic and institutional development of the country (Table-3).

Table-3 Main directions
Global Innovation Index (GII)[9]

1. INSTITUTIONS	
1.1.Political environment:	
1.1.1. Political and operational stability	1.1.2. Government efficiency
1.2. Legislative framework:	
1.2.1. Regulator quality	1.2.3. The cost of dismissal due to staff reduction, salary weeks
1.2.2. Law supremacy	
1.3. Business environment:	
1.3.1. Ease of starting a business	1.3.2. Ease of resolution of bankruptcy
2. HUMAN CAPITAL AND RESEARCH	
2.1. Education:	
2.1.1. Expenditure on education (% of GDP)	2.1.4. Grades in Reading, Math, and Science
2.1.2. Public funding per student, average, % of GDP per capita	2.1.5. Student-teacher ratio, secondary education
2.1.3. Duration of education	
2.2. Higher education:	
2.2.1. Admission to higher education institutions (% of total applicants)	2.2.2. Graduates of the Faculties of Natural Sciences and Engineering, %
Share of foreign citizens in higher educational institutions (%)	
2.3. Research and Development (R&D):	
2.3.1. Researchers (equivalent to full-time workload per population in millions)	2.3.3. Global R&D companies, average spending US$ million
2.3.2. Gross expenditure on research and development (% of GDP)	2.3.4. Average score of the top 3 universities by QS ranking
3. INFRASTRUCTURE	
3.1. Information and Communication Technology (ICT):	
3.1.1. Access to ICT	3.1.3. Government online services
3.1.2. Use of ICT	3.1.4. E-participants
3.2. General infrastructure:	
3.2.1. Electricity, mln./kW per population	3.2.2. Logistics performance
3.2.3. Gross capital formation, in % of GDP.	
3.3. Environmental sustainability:	
3.3.1. GDP per unit of energy use	3.3.2. Environmental indicators
3.3.3. Environmental certifications ISO 14001/bn. GDP PPP	
4. MARKET DEVELOPMENT	
4.1. Credit:	
4.1.1. Ease of getting a loan	4.1.2. Domestic credit to the private sector, % of GDP
4.1.3. Loan portfolio of microfinance organizations, % of GDP	
4.2. Investments:	
4.2.1. Ease of protecting minority investors	4.2.2. Market capitalization, % of GDP
4.2.3. Venture capital deals / billion GDP in PPP dollars	
4.3. Trade, competition and market scale:	
4.3.1. Applicable tariff rate, weighted average, %	4.3.2. Intensity of local competition
4.3.3. Volume of the domestic market, billion dollars at PPP	
5. BUSINESS DEVELOPMENT	
5.1. Knowledge workers:	
5.1.1. Employment in science-intensive industries, %	5.1.3. Gross spending on research and development carried out by business enterprises, % of GDP

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[9] Compiled by the author based on data from The Global Innovation Index 2015. R.203-208.

5.1.2. Firms offering formal training, %	5.1.4. Gross spending on research and development financed by business enterprises, %
5.1.5. Women working with advanced degrees, %	
5.2. Innovative links:	
5.2.1. Scientific cooperation between universities and industry	5.2.3. Gross spending on research and development financed by a foreign party, % of GDP
5.2.2. Status of cluster development	5.2.4. Joint venture/strategic alliances / billion GDP in PPP dollars
5.2.5. Patent applications filed with two offices / billion GDP in PPP dollars	
5.3. Knowledge Absorption:	
5.3.1. Payments for intellectual property, % of total trade	5.3.3. Import of ICT services, % of total trade
5.3.2. High technology imports, % of total trade	5.3.4. Net FDI inflow, % of GDP
5.3.5. Research talent in business (% of private enterprises)	
6. KNOWLEDGE AND TECHNOLOGY	
6.1. Knowledge Creation:	
6.1.1. Patent applications by origin / billion USD PPP GDP	6.1.3. Utility models by origin / billion GDP in PPP dollars
6.1.2. International applications for international cooperation in the field of patent cooperation / billion USD PPP GDP	6.1.4. Scientific and technical publications / billion GDP in PPP dollars
6.1.5. Citation of documents (H-index - H-index)	
6.2. Knowledge Influence:	
6.2.1. Growth rate of GDP per worker at PPP,%	6.2.3. Spending on computer software (% of GDP)
6.2.2. Number of new enterprises per capita from 15 to 64 years	6.2.4. ISO 9001 quality certifications / billion GDP PPP
6.2.5. High-tech and medium-tech production, %	
6.3. Dissemination of knowledge:	
6.3.1. Receipts from intellectual property, % of total trade	6.3.3. Export of ICT services, in % of total trade
6.3.2. Чистый экспорт высокотехнологичных товаров, в % от общего объема торговли	6.3.4. Чистый отток ПИИ, % ВВП
7. CREATIVITY	
7.1. Intangible assets:	
7.1.1. Trademarks by origin / billion USD PPP GDP	7.1.3. Industrial designs by origin / billion GDP in PPP dollars
7.1.2. Global Brand Value, Top 5,000, % of GDP	7.1.4. Creation of ICT and organizational model
7.2. Creative goods and services:	
7.2.1. Export of cultural and creative services, % of total trade	7.2.3. Entertainment and media market / d. pop. 15-69
7.2.2. Created national feature films / mln. 15-69	7.2.4. Printing and other media, % production
7.2.5. Export of creative goods, % of total trade	
7.3. Internet creativity:	
7.3.1. Generic top-level domains (TLDs) / populated. 15-69	7.3.3. Annual changes in Wikipedia / min pop. 15-69
7.3.2. Country Top Level Domains (TLDs) / Number of inhabitants 15-69	7.3.4. Creation of mobile applications / billion GDP in PPP USD

Based on the indicators in Table-6, it can be concluded that out of 109 sub-indices, 31 are directly related to the areas of macroeconomics. Accordingly, the positive results of these sub-indices will indicate the positive results of the country's macroeconomic indicators.

Literature

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