

**INNOVATIVE INFRASTRUCTURE EFFICIENCY ASSESSMENT INDICATORS
AND THEIR DEVELOPMENT STAGES****B.F.Azimov***Asia International University Associate Professor of the
" Economics" Department :*

Abstract: This article provides an in-depth analysis of methodological approaches, international experiences and indicators for assessing the effectiveness of innovation infrastructure. The article analyzes various economic bulletins and manuals, including statistical approaches based on the Frascati and Oslo manuals, as well as the stages of development of indices such as the Global Innovation Index. Also, a comprehensive approach is developed based on a system of indicators for assessing innovation potential, costs and results proposed by Uzbek scientists and foreign researchers. The indicators of the effectiveness of innovation infrastructure at the macro, meso and nano levels are considered in groups. As a result innovative activity efficiency territorial and institutional at the level assessment opportunity giver indicators system offer is being done .

Key words: innovative infrastructure , efficiency indicators , evaluation methodology , Frascati Manual , Oslo Manual , Global Innovation Index, innovation potential , R&D, patents , innovation activity , technological development , indicators system

World in practice innovative infrastructure development level appraiser many various indicators available . Innovative infrastructure efficiency whether it is national be it regional at the level let's see , evaluate indicators system national and territorial to the features is based on .

Regional innovative infrastructure under the influence innovative activity measurement his/her territorial features because of complicated is a problem . The whole head innovative infrastructure activity analysis to do for only one from the indicator use methodological from a point of view many problems brought release possible ¹.

Frascati Manual since creation since many in countries research and experimental design works according to information systematic accordingly collected ². Quite a lot far periods during patents whole world patent offices by record arrived Bibliometric information publications announcement to be done and this to publications quotes wide in appearance Oslo Guide instructions according to statistics offices farm driver from subjects their innovations about straight away requests are being held ³.

Innovative infrastructure results as of the company , of the region or of the country innovative potential and the results assessment for this analysis which indicators based on done increase understanding need . That's all . attention worthy , innovative indicators system himself/herself last one how many ten annuals inside noticeable to changes face came .

¹ Erqian Zhu. University of Nevada, Reno. Essays on Factors of Innovation, Regional Economic Impacts from Rangeland Fires, and Estimation of Health Impacts from Wildfires. A dissertation submitted in partial fulfillment of the Requirements for the degree of Degree of Philosophy in Resource Economics by Erqian Zhu, Nevada, December, 2010, page 9-10.

²OECD (1963), Frascati Manual 1963: Proposed Standard Practice for Surveys of Research and Development, The Measurement of Scientific and Technological Activities, OECD Publishing, Paris, <https://doi.org/10.1787/a9f6ca4b-en>.

³ https://www.oecd.org/content/dam/oecd/ru/publications/reports/2005/11/oslo-manual_g1gh5dba/9785760201737-ru.pdf

That is. innovative infrastructure under the influence innovative activity assessment indicators priority historical in periods changing went . Innovative infrastructure efficiency assessment issue , especially in the second half of the 20th century half starting from , economic politics important structural part as seeing is being released . This the period conditional 5 historical to the stage we will be :

1. 1950s–1970s: Scientific research expenses based Rating :

Second world from the war then society science of progress main driving force power and of innovations main source as acceptance did the research and to developments investment to enter separately attention This approach is called “input-based evaluation ,” meaning to the process included resources based on assessment priority was . During this period innovative infrastructure mainly state by funded research institutes through formed . This because of , the main efficiency indicators of the following consists of was :

- Research and experimental design allocated to research and development (R&D) amount of funds ;
- Scientific employees number ;
- Printed scientific articles number ⁴.

2. 1980–1990: Patents and commercialization Level :

Neoliberal economic politics in the background state intervention decrease , private sector activation was observed . During this period innovations financial results with tie trend increased . Therefore in evaluation following indicators important place occupied :

- Patent applications and given patents number ;
- Commercialized innovations level ;
- Technology transfer size ⁵.

3. 2000–2010: Innovative systems and them evaluation complex Indicators : National innovative system (NIS) concept based on efficiency complex in a way surveyor indexes created ⁶:

- Global Innovation Index (GII);
- Innovation Output Indicator (European Commission);
- Knowledge Economy Index (World Bank) ⁷.

These indicators not only patents and scientific activity , maybe education quality , infrastructure development , information technologies level , state of the policy flexibility such as factors as well inside takes ⁸.

4. 2010 to present to date : Sustainability , inclusion and social Impact :

Near in years innovative infrastructures in evaluation only economic benefit not , maybe

⁴Godin, B. (2005). Measurement and Statistics on Science and Technology: 1920 to the Present. Routledge.

https://www.routledge.com/Measurement-and-Statistics-on-Science-and-Technology-1920-to-the-Present/Godin/p/book/9780415649995?srltid=AfmBOooZ_x0VCK1PQi8BXDsMp9HvYzbaQ6QOIImmi7OwP3XgU-y_A9Z0p&utm

⁵OECD. (1992). Technology and the Economy: The Key Relationships. OECD Publishing. Academia.

<https://www.amazon.com/Technology-Organization-Economic-Co-operation-Development/dp/9264136223?>

⁶Freeman, C. (1987). Technology Policy and Economic Performance: Lessons from Japan. Pinter Publishers.

<https://archive.org/details/technologypolicy00free/page/n5/mode/2up?>, Lundvall, B. Å. (1992). National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning. Pinter Publishers.

<https://www.jstor.org/stable/j.ctt1gxp7cs?utm>

⁷World Bank. (2009). Knowledge Economy Index (KEI) Methodology and World Bank Operations. https://documents1.worldbank.org/curated/en/695211468153873436/pdf/358670WBI0The11dge1Economy01PUBLIC1.pdf?utm_source

⁸Dutta, S., Lanvin, B., & Wunsch-Vincent, S. (Eds.). (2014). The Global Innovation Index 2014: The Human Factor in Innovation. WIPO. https://www.wipo.int/edocs/pubdocs/en/economics/gii/gii_2014.pdf?

social and ecological efficiency is also taken into account is being taken . Innovative of activity stable to develop added contribution , social equality and ecological to balance the effect appraiser indicators increasingly current become is coming :

- Innovation Index (based on the United Nations Development Programme);
- Inclusive Innovation Index (MIT, 2017);
- Green Innovation Indicators (OECD, 2020).

Innovation of activity development new ideas working exit and personnel potential from development pull until financial , material and technical , information , legislative , methodological and organizational up to supply was innovative of the process basis organization doer various events of the complex done increase demand does . From that come out , from Uzbekistan from the authors Y. E. Aliev innovative development rating in the making experts 7 to the criterion justification explains :

- Research and to developments being directed expenses ;
- GDP composition (shares in appearance) ;
- In GDP technological working release value ;
- In industry efficiency ;
- In the country high technologies in the sector computers number ;
- Services of the scope developed ;
- Professional researchers number ;
- Patents number ⁹.

Many research usually innovative measurements two to the group distinguishes : innovation current to be and innovations results . But , Deepak Hegde own dissertation at work following indicators recommendation will ¹⁰:

1. Every thousand person between innovative those employed in the field number , B;
2. Capital investments volume , Kg;
3. Capital investments intensity , KQ/B;
4. Research and experimental design to their work expenses , X (ITTKI);
5. Research and experimental design works intensity , X (ITTKI)/B;
6. Patents number , P;
7. Patents intensity , P/X (ITTKI);
8. Technologies transfer (patents) commercialization) number , TTS;
9. Technologies transfer (patents) commercialization) period , priority year – TTS year ;
10. Innovative companies activity show period (year).

T. Kashitsina by innovative infrastructure development level innovative infrastructure objects point of view from the point of view not , maybe their innovative in process from the participation come came out without assessment to the goal compatibility knocking is ¹¹passed . Many scientists innovative activity innovative potential with In this place innovative potential concept subjects at your disposal innovative activity done increase for necessary was of resources generalized features as used . O. Avanesyan in research as shown ,

⁹ Y. E. Aliev . Innovative Economics . Education manual . - Tashkent: Economics , 2019 , 236 pages.

¹⁰Essays on Institutions and Innovation by Deepak Hegde. A dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy in Business Administration in the Graduate Division of the University of California, Spring 2010, 80p.

¹¹Methodology for the development of innovative infrastructure in the region, thematic dissertation and abstract of VAK RF 08.00.05. Kashitsyna Tatyana N i kolaevna . 2009

innovative activity done increase (research) transfer or new product for output) company following main resources to the collection has to be need because :

- ◆ Production release objects and / or research base ;
- ◆ Necessary to the qualification has was employees ;
- ◆ Scientific data , production release technologies and others ;
- ◆ Development or working release for finance ;
- ◆ Information resources ;
- ◆ Products to the market to release providing distribution networks ¹².

Above cited from thoughts come out in our opinion , innovative infrastructure of subjects relevant to the levels to be issued without innovative infrastructure subjects activity assessment indicators following to groups divided without analysis to do (Table 1). Innovative infrastructures of the region scientific , technological and economic potential in increasing solution doer role burn in consideration take his/her efficiency clear and objective assessment for modern and complex approach necessary . Research within working issued integral assessment model capacity , costs and results each other related system as seeing It turns out that in the model included indicators quantitative (e.g. , innovative to projects separated funds , foreign investments size , innovative products size) and qualitative-expert (e.g. , personnel) capacity , infrastructure organization doneness level) type to be because of to measure them in a single way to bring need is born .

This point of view in view of all Converting numbers to natural logarithms (ln) through analysis to do methodological in terms of to the goal appropriate become indicators between dispersion and size differences to reduce , m data distribution to the normal distribution approximation , exponential growing or sharp differentiable indicators the impact to soften and indicators to analysis impact level logarithmic elasticity through to explain opportunity creates . Conclusion as in other words , regional innovative Integrated assessment of infrastructure model through his/her socio-economic efficiency determination opportunity is created . This is state and territorial management to the organs innovative strategies further effective planning and done increase for necessary basis to be service does .

Table 1

Innovative infrastructure elements integral indicators of activity schedule

¹²RAZVITIE INNOVATIONNOY INFRASTRUKTURY NA OSNOVE KORPORATIVNOY RESTRUKTURIZATsII. 08.00.05 - Economics and management of the national economy (management of innovation and investment activity) 2008. AVANESYAN Oleg Sergeevich

Infrastructure level	Innovative potential	Innovative expenses	Innovative fruit
1. International Macro (country, region, area)	1. IT staff share (total) To the BSS relatively) 2. Scientific institutions number / population number 3. Innovative education programs share 4. Patent applications number / 1 million population 5. Research enterprises number / 100 enterprises 6. Scientific potential index / GDP	1. Innovative expenses / GDP 2. State subsidies / general cost 3. Foreign investments / general innovation cost 4. Private sector cost / total innovation cost 5. Competitive grants number / projects number 6. R&D separated funds / budget expenses	1. To be created new technologies number / 1 million population 2. Commercialized patents share 3. Export-oriented new products share 4. Created innovative work positions / general work places 5. Technological product export / general export 6. Innovative active subjects share
2. Meso Micro (network enterprise)	1. Scientific and innovative department there is enterprises share 2. Scientific employees share / total employees 3. Patented developments share / total developments 4. In the enterprise new product projects / general projects 5. Innovative collaboration (R&D cooperation) / general cooperation 6. In the enterprise study courses number / per 100 employees	1. Enterprise innovative consumption / total cost 2. To innovation separated expense / income 3. Scientific to research consumption / total budget 4. Innovative project per head spending 5. For one patent spending 6. Private spending share / total spending	1. New current done technologies share 2. Updated products share 3. Economy made cost / total cost 4. News current done resulting income share 5. Innovative from the product fallen profit / general benefit 6. Scientific development based on current made projects share
3. Nano (physical individuals)	1. Scientific to the title has individuals share 2. Scientific articles number / year 3. At the conference participation number / year 4. Created by startups number / person 5. Scientific in projects participation / general activity 6. Creative ideas number / year	1. Research to the activity personal spending / income 2. Grants share / personal funds 3. A project for spending made hours 4. Patent applications number / research 5. Separated funds / taken knowledge number 6. For every 1 project consumption / product process	1. Scientific in articles quotes number / article 2. Patented developments share 3. Startup benefit / expense 4. Scientific of projects practical results number 5. Proposal done of ideas acceptance to be done 6. To one person right arrived innovative project number

References:

1. Qudratova, G. M. (2025). TEXNOLOGIK PARKLARNING MINTAQHA INNOVATSION RIVOJLANISHINI TA'MINLASHDAGI AHAMIYATI. YANGI O'ZBEKISTON, YANGI TADQIQOTLAR JURNALI, 2(8), 170-178.
2. Sodiqova, N. (2025). IQTISODIYOT FANLARINI O'QITISHDA TALABALAR TEXNIK TAFAKKURINI RIVOJLANTIRISHNING AMALDAGI HOLATI VA TAKOMILLASHTIRISH YO'LLARI. " ПЕДАГОГИЧЕСКАЯ АКМЕОЛОГИЯ" международный научно-методический журнал, 2(19).
3. Bahodirovich, K. B. (2025, April). STRUCTURE OF THE CASH FLOWS STATEMENT. In CONFERENCE OF MODERN SCIENCE & PEDAGOGY (Vol. 1, No. 1, pp. 325-330).
4. Алимова, Ш. А. (2025). УСТОЙЧИВЫЕ ЦЕПОЧКИ ПОСТАВОК: ОТ ТРЕНДА К НЕОБХОДИМОСТИ РАСШИРЕННАЯ ВЕРСИЯ. Modern Science and Research, 4(5), 76-81.
5. Toshov, M. H. (2025). SANOAT KORXONALARIDA MEHNATGA HAQ TO'LASH TIZIMINI BOSHQARISH. Modern Science and Research, 4(4).
6. Azimov, B. (2025). METHODS AND MODELS FOR ASSESSING THE SOCIO-ECONOMIC EFFICIENCY OF REGIONAL INNOVATION INFRASTRUCTURE. International Journal of Artificial Intelligence, 1(3), 685-691.
7. Ikromov, E. I., & Safarova, J. (2025). O'ZBEKISTONDA YASHIL TADBIRKORLIKNI HUDUDLARDA RIVOJLANTIRISHI ISTIQBOLLARI. Modern Science and Research, 4(4), 421-428.

8. Raxmonqulova, N. O. (2025). DEVELOPMENT OF THE DIGITAL ECONOMY ON A GLOBAL SCALE AND THE EXPERIENCE OF COUNTRIES. SHOKH LIBRARY.
9. Shadiyev, A. X. (2025). MINTAQANING IJTIMOY-IQTISODIY RIVOJLANISHINI BOSHQARISH MEXANIZMINI TAKOMILLASHTIRISH. STUDYING THE PROGRESS OF SCIENCE AND ITS SHORTCOMINGS, 1(7), 145-150.
10. Naimova, N. (2025). THE IMPACT OF GLOBALIZATION ON MODERN ECONOMIC PROFESSIONS. Journal of Multidisciplinary Sciences and Innovations, 1(2), 153-155.
11. Bazarova, M. (2025). FEATURES OF ASSESSING THE EFFECTIVENESS OF INNOVATION RISK MANAGEMENT OF AN EDUCATIONAL ORGANIZATION IN THE PROCESS OF DIGITAL TRANSFORMATION OF ACTIVITIES. Journal of Multidisciplinary Sciences and Innovations, 1(2), 161-164.
12. Jumayeva, Z. (2025). THE ROLE OF MICROECONOMIC ANALYSIS IN ENHANCING ECONOMIC EFFICIENCY THROUGH MARKET EQUILIBRIUM ANALYSIS. International Journal of Artificial Intelligence, 1(3), 634-637.
13. Bobojonova, M. (2025). GREEN ENTREPRENEURSHIP IN UZBEKISTAN AND ITS OPPORTUNITIES. International Journal of Artificial Intelligence, 1(3), 592-595.
14. Jumayeva, Z. (2025). THE FORMATION OF THE GREEN ECONOMY CONCEPT, STAGES OF DEVELOPMENT AND ITS RELEVANCE. International Journal of Artificial Intelligence, 1(3), 262-266.
15. Ibragimov, A. (2025). TAX POLICY AND IMPACT ON ECONOMIC DEVELOPMENT. International Journal of Artificial Intelligence, 1(3), 259-261.
16. Djurayeva, M. (2025). ISSUES OF SMALL BUSINESS AND PRIVATE ENTREPRENEURSHIP DEVELOPMENT. International Journal of Artificial Intelligence, 1(3), 596-598.
17. Umarova, H. (2025). RIVOJLANGAN MAMLAKATLARDA KORXONA RISKLARINI BOSHQARISH VA BAHOLASH AMALIYOTI TAHLILI. Modern Science and Research, 4(5), 158-161.