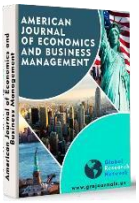

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Article

Methodology and Indicators for Measuring the Level of Digitalization in a Country's Economic Development

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Abstract: The process of digitalization, which is becoming one of the important conditions for economic development in the 21st century, has created the need for its comprehensive assessment and in-depth analysis. There are various international methods and indicators for determining the impact of digitalization and digital economy development programs on society, which are used in different countries, each of which is characterized by the formation of an average indicator by summarizing various digitalization-related factors. The aim of the article is to analyse various methodology and indicators for measuring the level of digitalization in a country's economic development. Particularly, digital indicators such as ICT Development Index, Digital Economy and Society Index, IMD World Digital Competiveness Index, Digital Economy and Society Index, e-Intensity, Networked Readiness Index, Global Cybersecurity Index, The UN Global E-Government Development Index and The Global Innovation Indexes were analyzed and compared according to its measurements.

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1. Introduction

The process of digitization, which is becoming one of the important conditions for economic development in the 21st century, has created the need for its comprehensive assessment and in-depth analysis. There are various international methods and indicators for determining the impact of digitization and digital economy development programs on society used in different countries, each of which is characterized by the formation of an average indicator by summarizing various digitalization-related factors[1]. Indicators such as the ICT Development Index, the Digital Economy and Society Index, the IMD World Digital Competitiveness Index, the Boston Consulting Group's Digital Economy Index (e-Intensity), the Networked Readiness Index, the Global Cybersecurity Index, the UN Global E-Government Development Index, the E-Participation Index, and the Global Innovation Index summarize various economic indicators of countries and form a list of digitally advanced or backward countries.

2. Materials and Methods

This study employs a comparative analytical approach, combining quantitative analysis of secondary statistical data with desk research of international methodological frameworks for assessing the level of digitalization in national economies.

Data were obtained from reputable international organizations and research institutions that publish standardized digitalization indices. The primary sources include:

a. International Telecommunication Union (ITU) – ICT Development Index and sector-specific indicators.
b. European Commission – Digital Economy and Society Index (DESI).
c. IMD World Competitiveness Center – World Digital Competitiveness Index (WDCI).
d. Boston Consulting Group – e-Intensity Index.
e. Portulans Institute & World Economic Forum – Networked Readiness Index (NRI).
f. United Nations Department of Economic and Social Affairs (UNDESA) – Global E-Government Development Index (EGDI) and E-Participation Index (EPART).
g. International Telecommunication Union & Global Cybersecurity Agenda – Global Cybersecurity Index (GCI).
h. World Intellectual Property Organization (WIPO) – Global Innovation Index (GII).

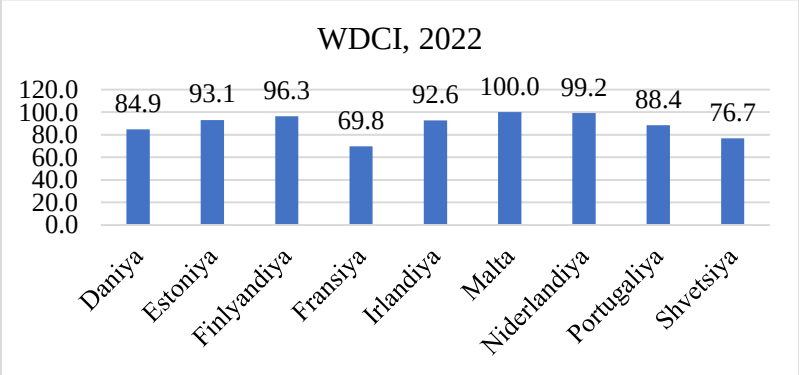
These sources were selected to ensure methodological consistency, international comparability, and coverage of multiple dimensions of digitalization.

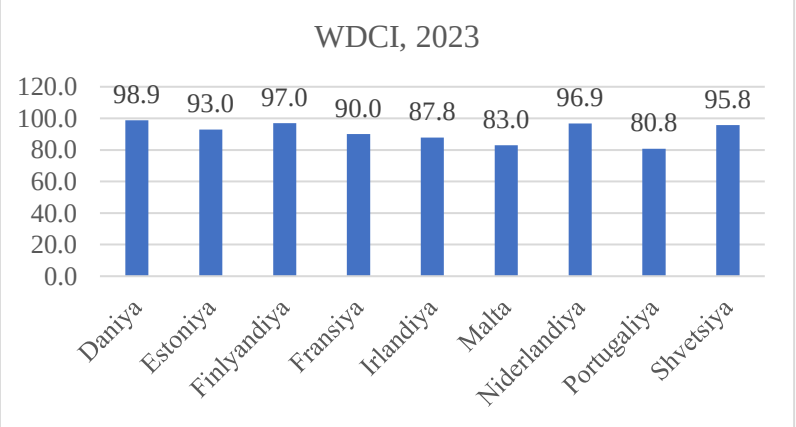
3. Results and Discussion

The Digital Economy and Society Index (DESI) is a European Union-published digital index that aims to compare, analyze and identify trends in the digital performance of 45 countries, combining 24 different data sets published by the European Union since 2014. The index is aligned with the four pillars ("skills", "infrastructures", "business", "government") set out in the Commission's proposal for a European Union "Roadmap to a Digital Decade", and serves as a basis for setting targets for a country's sustainable digital transformation[2].

The Digital Economy and Society Index is formed by calculating the overall arithmetic mean of the above indicators, that is, this "S" is calculated for a country as follows:

DESI(C) = Human Capital (C)*0,25 + Network (C)*0,25 +
Digital Technology Integration (C)*0,25 + Digital Society (C)*0,25 (1).





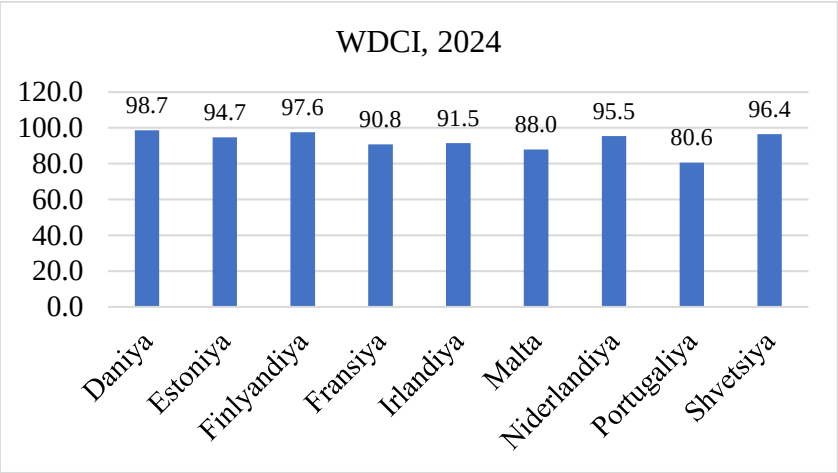


Figure 1. Ranking of countries by Digital Economy and Society Index.

Figure 1, this figure presents the ranking of countries based on the Digital Economy and Society Index (DESI), which evaluates the digital performance and competitiveness of countries in the European Union. The index is made up of several dimensions, including digital infrastructure, digital skills, online services, and the integration of digital technology by businesses and public services. The ranking shows how different nations are advancing in the digital economy, reflecting their efforts to improve connectivity, technological innovation, and digital adoption among citizens and businesses.

The World Digital Competitiveness Index, proposed by the Swiss IMD business school, assesses the extent to which a country is developing and implementing digital technologies that are transforming the economy and society for the better. The Digital Competitiveness Index is determined by the average sum of three sub-indices, which indicate the level of digital literacy, technology and future readiness[3].

The first sub-index of the WDCI, digital literacy, is the basis of the digital transformation process, assessing the level of skills to invent and use advanced digital technologies. The technology sub-index assesses the favorable environment for digital development in the country. This, in turn, includes factors that stimulate the development of entrepreneurial activity and innovation, as well as the regulatory and legal framework introduced by the government. The future readiness sub-index assesses the level of readiness of the economy for digital transformation, studies the degree of adaptability of enterprises to different conditions and how quickly they can change their business models to meet the needs of the times[4]. The Future Readiness Index also assesses how well ICT is integrated into the economy and business processes.

The WDCI ranks the economies of 64 countries. This index is calculated based on 34 statistical and 20 survey data, based on a total of 54 assessment criteria. These are summarized into 9 sub-indices, respectively, and these sub-indices are divided equally into 3 sub-indices (digital literacy, technology and future readiness), as mentioned above.

One of the indicators that reflects the global digital development process in the world is the Digital Intelligence Index (DII) developed by Tufts University. Based on this index, the digital development indicators of more than 90 countries are studied, and as a result of the analysis, a Digital Trust and Digital Evolution rating are compiled. Digital Evolution studies the economies of countries into 4 areas (Figure 1.5): 1. “Stand Outs” (“leading” countries) are a group of countries with a highly developed digital economy and high growth rates. The population of such countries actively uses the conditions provided by the Internet. Due to the fact that their digital infrastructure has been developed for many years, the economies of these countries have stable growth rates[5]. On the other hand, due to the increasing complexity of introducing new innovations, such countries need to

introduce continuous digital innovations in order not to stop developing digital technologies. The economies of countries such as Singapore, the United States, Hong Kong, the Republic of Korea, the UAE, Taiwan, and Germany belong to the economies of this region.

Table 2. Ranking of countries by digital evolution.

State of Digital Evolution	"Stall Outs"	"Stand Outs"
	Finland, Denmark, Switzerland, Iceland, Netherlands, New Zealand, Australia, Canada, Austria, Belgium, France, Japan, United Kingdom	Singapore, USA, Hong Kong, Taiwan, Republic of Korea, Germany, Estonia, UAE, Israel, Malaysia, Qatar
	"Watch outs"	**"Break Outs"**
	Slovakia, Italy, Hungary, Greece, Romania, North Africa, Turkey, Costa Rica, Mexico, Colombia, Jordan, Philippines, Bosnia, Sri Lanka, Egypt, etc.	Latvia, China, Poland, Bahrain, Saudi Arabia, Chile, Bulgaria, Thailand, Uruguay, Russia, Georgia, Azerbaijan, Argentina, Vietnam, Indonesia, India, Kazakhstan, Kenya, Morocco, Bolivia, etc.
	Digital Evolution Momentum	

Table 2, ranking of Countries by Digital Evolution categorizes countries into four groups based on their digital development: "Stall Outs" (e.g., Finland, Japan) have slowed growth, "Stand Outs" (e.g., Singapore, USA) lead with advanced digital economies, "Watch Outs" (e.g., Slovakia, Egypt) face challenges, and "Break Outs" (e.g., China, India) show promising digital growth. The ranking reflects each country's digital evolution momentum and potential for further development.

2. "Stall Outs" ("countries with a "slow growth rate") — this group includes countries whose growth rates have slowed down in recent years, but have developed digital economies. In order not to lag behind in economic development, these countries need to follow the example of countries in the "Stand Outs" category. The economies of countries such as Finland, Denmark, Switzerland, Norway, Japan, Austria belong to the "Stall Outs" group[6].

3. "Break Outs" ("promising" countries) — countries in this group, although they have a lower rating in terms of digital development, have high development rates. Rapid growth trends and the conditions created for digital development in the country attract investors[7]. These countries include China, India, Indonesia, Saudi Arabia, Kenya and Russia, and they have the potential to enter the "Stand Outs" group in the future.

4. "Watch outs" – the economies of countries in this group have serious problems due to low digitalization rates and slow development rates. "Watch out" economies include the economies of countries such as Nigeria, Uganda, Sri Lanka, Romania, North Africa, and Brazil[8].

The following factors are used to study the digital evolution in groups: demand for digital infrastructure, supply that meets this demand, institutional environment and innovation.

The second indicator within the Digital Intelligence Index is "Digital Trust", which shows the level of trust that the population has in all processes related to the Internet (consumption, transactions, commerce, etc.). "Digital Trust" is an indicator that determines the level of relationship between the parties that provide trust (user, consumer, citizen) and the guarantor of the given trust (enterprise, legal entity). In this, the environment and experience of the guarantor are studied, and the attitude and behavior of the trusting party are studied.

In world practice, various other indices are also used to assess the level of digitalization in individual sectors of the economy, including:

a. Networked Readiness Index (NRI), which assesses this ability;
b. The UN Global E-Government Development Index (EGDI);
c. The E-Participation Index (EPART), which characterizes the level of development of active communication services between citizens and the state;
d. The Global Cybersecurity Index, etc.

The COVID-19 pandemic in 2019 proved that many countries were not ready to overcome the global crisis. This has led to an increase in efforts to build a sustainable digital society and a transition to a centralized digital government transformation over the past 5 years[9]. It is worth noting that economic sanitation has dramatically increased the importance of e-government and digital technologies in practice as an important tool for communication and cooperation between policymakers, the private sector and society around the world. The creation of a single public services portal (my.gov.uz) within the framework of digital government in our country has significantly simplified the interaction of society with the government[10-11].

One of the most widely used integral indicators in the field of digitization of government administration is the e-Government Development Index (EGDI), which is calculated by the UN every 2 years for all 193 member states of the organization. This index was first calculated in 2001[12]. The index is based on statistical indicators of the government's assessment of national websites and its participation in the information society. From a mathematical point of view, the EGDI is the normalized arithmetic mean of three independent indicators, including (1) the scope and quality of online services (Online Service Index, OSI); (2) the state of development of telecommunications infrastructure (Telecommunication Infrastructure Index, TII); (3) the specific human capital index (Human Capital Index, HCI):

$$EGDI = 1/3\ (〖OSI〗\_normalized + 〖TII〗\_normalized + + 〖HCI〗\_normalized) \quad (2)$$

Here, the OSI index represents national websites providing government services: the national portal, the e-services portal, the e-participation portal, and the relevant portals of the ministries of education, labor, social services, health, finance, and the environment through indicators based on the study and evaluation[13].

The next component of the e-government index, the TII index, is the arithmetic mean of the following 5 indicators: (1) the number of Internet users per 100 inhabitants; (2) the number of fixed telephone lines per 100 inhabitants; (3) the number of mobile subscribers per 100 inhabitants; (4) the number of wireless broadband connections per 100 inhabitants; (5) the number of broadband connections per 100 inhabitants. The components of these indicators change over time due to the emergence of modern digital technologies (for example, since 2008, the number of televisions has not been taken into account when calculating the TII)[14].

The HCI index is an index that measures the literacy level of the population, which is determined on the basis of 4 statistical indicators, namely: (1) the literacy rate of the older

population; (2) the gross coefficient of enrollment in general primary, secondary and higher education institutions; (3) expected years of education; (4) average years of education[15].

4. Conclusion

Due to the great attention paid to the development of e-government in the conditions of the new Uzbekistan, it is gradually improving its ranking in this regard on a global scale. In particular, in 2022, Uzbekistan ranked 69th out of 193 countries in the EGDI ranking, becoming one of the countries with high EGDI indicators. For comparative analysis, in 2020, Uzbekistan ranked 87th and in 2018, it ranked 81st. In 2024, Uzbekistan scored 32.7 points out of a possible 120, ranking 60th out of 77 countries. At the same time, Uzbekistan is included in the list of developing countries that demonstrate an initial level of maturity in the field of information and communication technologies and the economy. Among neighboring countries, Kazakhstan is in 58th place, and other Central Asian countries are not included in the index.

The study shows that the index covers countries accounting for 93 percent of global GDP and 80 percent of the population and provides a global picture of progress in digital transformation.

Countries such as Denmark, Finland, the Republic of Korea, New Zealand, Sweden, Iceland, Australia, Estonia, the Netherlands, the United States, the United Kingdom, Singapore, the United Arab Emirates, Japan and Malta are among the countries with the highest EGDI indicators.

It should be noted that for the successful digitization of the national economy, it is important to analyze the digitization systems of leading countries with extensive experience in this regard and implement the results in practice, adapting them to the country's conditions. It is important to achieve the goal of achieving sustainable economic development in the long term based on the creative application of successful experiences of foreign countries in the national economy.

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