

## UKRAINE IN INTERNATIONAL INDEXES OF INFORMATION SOCIETY DEVELOPMENT

### МІСЦЕ УКРАЇНИ У МІЖНАРОДНИХ РЕЙТИНГАХ РОЗВИТКУ ІНФОРМАЦІЙНОГО СУСПІЛЬСТВА

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**Abstract.** *The article studies the main ranks and indexes of information society development in Ukraine. Program documents, adopted during The World Summit on the Information Society (WSIS), became the basis for determining key components of information society: Information and communication infrastructure, capacity building, access to public domain information, security in the use of ICT, ICT applications, independence and plurality of media, research and innovations. For each component, several international indices were selected and Ukraine's position in these rankings was analyzed. Normalized indicators of ranking values of Ukraine were presented in the diagram, where Ukraine has the best position in the EU Open Data Maturity Report (ODM), and the worst result - Press Freedom Index (PFI). However, the overall score of more than 0.5 indicates a significant success of Ukraine on the way to information society.*

**Key words:** *global development, information society, global indices, Ukraine, ICT infrastructure, open data, information literacy, e-government, cyber security.*

**Анотація.** *Стаття присвячена аналізу основних показників впровадження інформаційного суспільства в Україні. Основою для визначення складових інформаційного суспільства стали програмні документи розвитку глобального інформаційного суспільства, зокрема документи, ухвалені під час Всесвітнього саміту з питань інформаційного суспільства (WSIS): інформаційна та комунікаційна інфраструктура, інформаційна грамотність, вільний доступ до інформації та знань, безпека використання ІКТ, електронні послуги, незалежність і плюралізм ЗМІ, дослідження та інновації. За кожним складовим було*

визначено ряд міжнародних рейтингів і проаналізовано місце України в ньому. Нормовані показники рейтингових значень України було представлено на діаграмі, де найкращі позиції Україна має в рейтингу *EU Open Data Maturity Report (ODM)*, а найгірший результат - *Press Freedom Index (PFI)*. Проте, загальний показник в понад 0,5 свідчить про значний успіх України на шляху до інформаційного суспільства.

**Ключові слова:** глобальний розвиток, інформаційне суспільство, глобальні індекси, Україна, ІКТ інфраструктура, відкриті дані, інформаційна грамотність, електронне урядування, кібербезпека.

**Problem Statement.** The key trend in the development of the modern world is the increasing role of information and the use of information and communication technologies (ICT) in all spheres of life. The effective use of information resources and ICT determines the pace of political and socio-economical development of the country, as well as its competitiveness in the international arena, and its position in the hierarchy of international actors.

Ukraine is a full member of the global community and actively participates in all global trends. The foreign policy priorities of Ukraine are European and Euro-Atlantic integration. The development of information society in the country is now a determinant for successful achievement of national interests and goals, as well as shaping favourable reputation of the country on the world stage.

In these conditions, it is important to study the level of information society development in Ukraine in recent years. Ukraine's position among other countries in the world in terms of information society development indicators can be traced through the analysis of relevant global indices.

**Analysis of the latest publications.** The attention to the measurement of various socio-political processes within political science has always been insufficient due to their stochastic nature. Mainly, we rely on data from international organizations and research institutions that have conducted comprehensive global or regional studies on the measurement of the level of information society development. At the national level, economists-internationalists such as N. Reznikova, O. Ivashchenko, N. Kurballa [Reznikova et al., 2020], A. Yerina [Yerina, 2016], L. Fedulova [Fedulova, 2009], O. Korepanov [Korepanov, 2018] pay attention to the indicators of information society development. N. Hornostai and O. Mykhalchenkova [Hornostai, Mykhalchenkova, 2021] examine the issues of developing the methodology of index analysis itself in their research, without focusing on the level of implementation of information society in Ukraine.

**The purpose** of the article is to analyze Ukraine's ranking in global indices of information society development.

**Presentation of the main research results.** International relations, as a scientific field, often faces challenges in measuring and standardisation processes that are inherently difficult to quantify, especially when it comes to comparing countries in areas such as democracy, freedom of speech, digital literacy, or the level of population inclusion in socio-political decision-making processes. In this regard, indices become the main mechanism for assessing these processes, developed by both international institutions, government agencies and civil society organizations.

The indices allow to compare countries using specific indicators and determine their level of development in various domains. They also serve as a convenient tool for measuring the progress and/or evaluating the effectiveness of measures taken by countries in specific areas of development. Furthermore, a country's rankings in global indices influence its international reputation and determine its position in the hierarchy of international actors.

The development of indices is typically based on a wide range of data from various sources, primarily official statistics from governments and international organizations, as well as empirical methods (such as normalization, ranking, expert analysis, statistical and sociological methods, etc.).

With the transition to the information society, or so called "knowledge society," the importance of indices has rapidly increased. The World Summit on the Information Society (WSIS) held in 2003 and 2005 defined that countries should move towards building an inclusive information society by ensuring universal access to information, knowledge and services based on ICT for all members of society.

As a result of WSIS, the Digital Opportunity Index was created to monitor the progress of countries in implementing information and communication technologies (ICTs) and the dynamics of information society development at the global and regional levels [WSIS, 2003-2005].

Currently, numerous indices have been developed by international and academic organizations to measure the level of information society development in different countries and regions. They help evaluate the accessibility of information technologies, the number of Internet users, the development of e-government services, ICT literacy levels and more. Information society indices are essential tools for understanding the dynamics of countries' development in the field of ICT and determining priority directions for social development to bridge the "digital divide" both among countries and within nations.

The use of many basic indicators in modeling the assessment of information society development makes it possible to evaluate the impact of each factor, identify weaknesses and pay more attention to the issues that hinder country's development.

However, information society indices do not consider cultural and ethical norms that influence how people use technologies and how they perceive them in society. Additionally, they do not consider social factors such as national health, social equality and justice, and other qualitative aspects that cannot be quantified. Overall, the limitations of most indices lie in the simplified reflection of complex process of information society development, subjective determination of indicators, their weighting, and calculation methods, as well as the outdated or irregular data collection practices.

Considering these drawbacks, it is reasonable to rely on a range of indices containing up-to-date data on the key aspects of the "knowledge society" to analyze the level of information society development in a particular country.

The basis for defining the components of information society can be found in program documents for the development of global information society, in particular those adopted during the World Summit on the Information Society [WSIS, 2003-2005].

These documents provide the opportunity to identify the fundamental components or aspects of information society, including:

- Information and communication infrastructure,
- Capacity building (education, ICT literacy, etc.)
- Access to public domain information,
- Security in the use of ICT (cybersecurity),
- ICT applications (e-government, e-business, e-learning, etc.),
- Independence and plurality of media,
- Research and innovations.

Based on the components of information society mentioned above, the level of information society development in Ukraine was analyzed using a range of international indices for the years 2020-2022.

The selected indices for each aspect of information society are reflected in the Table 1.

Table 1.

International Indices to assess country's information society development

<b>Key aspects of information society</b>	<b>Indices</b>
Information and communication infrastructure	Digital Readiness Index (DRI), Digital Quality of Life Index (DQL)
Capacity building	Global Knowledge Index (GKI), Digital Parity Scorecard (DPS)
Access to public domain information	EU Open Data Maturity Report (ODM)

Security in the use of ICT	Global Cybersecurity Index (GCI), National Cyber Security Index (NCSI)
ICT applications	E-government development index (EGDI)
Independence and plurality of media	Press Freedom Index (PFI)
Research and innovations	Global Innovation Index (GII)

The DRI measures the ability of 146 countries to use information technologies to achieve economic, social and political advantages. This index uses seven indicators, including technology infrastructure and technology adoption, ease of doing business, human capital development, business and government investment, basic human needs, and the start-up environment. The scores range from -1.89 to 2.37.

Ukraine ranks 79<sup>th</sup> overall. However, the country score differs by indicators. Ukraine has good performance in human capital and ranks 44<sup>th</sup>. The country's performance is not bad in technology infrastructure (62<sup>nd</sup> rank) and technology adoption (67<sup>th</sup> rank). At the same time Ukraine has very low score in business and government investment (124<sup>th</sup> rank) [*Digital Readiness Index, 2022*].

Another index that allows to evaluate the accessibility and quality of ICT is Digital Quality of Life Index (DQL). This index is based on five pillars: internet affordability, internet quality, e-infrastructure, e-security, e-government. These indicators give insights into what factors impact a country's digital wellbeing and which areas should be improved.

In 2021 Ukraine ranked 47<sup>th</sup> with overall score 0,56 out of 110 countries and in 2022 the country ranking dropped down to 50<sup>th</sup> with the score 0.49 out of 117 countries.

According to the index data, Ukraine shows some improvement in internet affordability (22<sup>nd</sup> rank in 2022 versus 28<sup>th</sup> in 2021) and in electronic infrastructure (37<sup>th</sup> in 2022 versus 42<sup>nd</sup> rank in 2021). At the same time there is a decrease in internet quality (from 68<sup>th</sup> rank in 2021 to 94<sup>th</sup> rank in 2022) and electronic security (from 25<sup>th</sup> rank in 2021 to 41<sup>st</sup> rank in 2022) [*Digital Quality of Life Index, 2022*].

Besides information and communication infrastructure, the education and information literacy, in particular skills to use ICTs, are key factors for building inclusive information society.

The Global Knowledge Index (GKI) measures human capital in different countries using seven sub-indices: pre-university education, technical and vocational education, higher education, research and development, information and communications technology, enabling environment, economic openness and competitiveness.

According to GKI data, Ukraine is a moderate performer in terms of its knowledge infrastructure. It ranks 63<sup>d</sup> out of 132 countries in the GKI 2022 and 8<sup>th</sup> out of the 28 countries with high human development. Ukraine's score is equal to the world average value 46.5.

The country performs the highest score in pre-university education (79.8 points, 18<sup>th</sup> rank) and the lowest value in research and development (23.9 points, 63<sup>d</sup> rank). Ukraine is behind world average score (52.9) in economic openness and competitiveness with 44.8 points and ranks 97<sup>th</sup> [*Global Knowledge Index, 2022*].

The research team of the Fletcher School's Institute for Business in the Global Context developed Digital Parity Scorecard (DPS) to track the progress of 90 countries towards inclusive information society. The scoreboard includes country ranking in the number of Internet users as well as in three inclusion dimensions: gender digital parity, socioeconomic digital parity and rural digital parity.

Ukraine has good progress in gender digital parity (93,25%) and lower progress in socioeconomic (57,93%) and rural (67,03%) digital parity.

In Ukraine, the number of Internet users in 2021 was 69.21% of the total population [*Global Digital Inclusion, 2021*].

At the start of 2022 Ukraine's internet penetration rate stood at 71.8 percent of the total population. The analysis by non-governmental organization Kepios indicates that internet users in Ukraine increased by 526 thousand (+1.7%) between 2021 and 2022 [*Kemp, 2022*].

The number of social networks users is also important to consider as it shows the use of digital tools for information exchange, communication and cooperation. This indicator also reveals a certain level of digital literacy in a country.

At the beginning of 2022 the number of users of social networks in Ukraine was 64.6 % of the total population (28 million inhabitants) [Kemp, 2022].

One of the core features of information society is free access to information and knowledge. In this context the access to public domain information plays very important role in information society as a key factor in ensuring openness and transparency of public authorities.

In 2015 EU launched data.europa.eu as a main point of access to public sector information published across Europe. Data.europa.eu's objective is to improve access to open data, foster high-quality open data publication at national, regional, and local level, and increase its impact.

With this portal EU launched Open data maturity measurement (ODM) that covers the policy developments at country level as well as the level of sophistication of the national open data portals.

Open (government) data is defined as the information collected, produced or paid for by the public bodies and made freely available for reuse for any purpose [Open Data in Europe, 2022].

The ODM assessment includes a set of indicators grouped in four clusters: open data policy, open data impact, open data portal and open data quality.

In 2022 Ukraine ranks 2<sup>nd</sup> out of 35 European countries. Ukraine entered the list of leading countries (trend-setters) along with France, Poland, Ireland, Cyprus, Estonia, Spain and Italy.

According to all indicators, Ukraine showed higher results than the overall average in Europe (79%). The country has the highest scores for open data policy and impact (100%). The areas of potential growth are open data portal (95%) and open data quality (93%). The key weaknesses are data provision (83%) and deployment quality (83%) [Open data maturity, 2022].

The access to open data laid foundation for online interaction between government and citizens. The e-government is a significant indicator of the progress in information society development.

The UN Global e-government development index tracks the progress of 193 countries in providing e-government services. It consists of three independent component indices: Online Services Index (OSI), Telecommunication Infrastructure Index (TII) and Human Capital Index (HCI). Each component includes subindices.

In 2022 Ukraine ranks 46<sup>th</sup> with overall score 0,8029. The country moved from the high to very high EGDI value.

In terms of OSI (0,8148) Ukraine has the highest score for institutional framework (national government portals) and content provision (availability of data in several languages).

The Telecommunication Infrastructure Index of Ukraine is also high (0,727). The country shows good performance in mobile cellular telephone and active mobile broadband subscriptions per 100 inhabitants.

In terms of the Human Capital Index of Ukraine has very high level of adult literacy (99, 97%) and percentage of students enrolled at the primary, secondary, and tertiary level (93,95%) [UN E-Government Survey, 2022].

Independent mass media are essential for information society as they provide the public with varied sources of information.

Press Freedom Index, published annually by international non-governmental organization Reporters without Borders, tracks the level of press freedom in 180 countries. Every country is evaluated using five contextual indicators: political context (the degree of support and respect for media autonomy by public authorities), legal framework, economic context (economic constraints for journalists), sociocultural context (social and cultural constraints, imposed on journalists) and journalists' safety.

In 2022 Ukraine ranks 106<sup>th</sup> and falls into the group of countries with problematic situation. Ukraine has good score for legislation (79,45 points, 36<sup>th</sup> rank) and very low score for journalists' safety (18,84 points, 165<sup>th</sup> rank) [Press Freedom Index, 2022].

The development of information society is impossible without research and innovations. The innovation capabilities of countries are presented in Global Innovation Index (GII). This index consists of 80 indicators, grouped into innovation inputs (institutions, human capital and research, market and business sophistication) and outputs (knowledge and technology outputs, creative outputs) [Global Innovation Index, 2022].

In 2022 Ukraine ranks 57<sup>th</sup> out of 131 countries. Ukraine performs better in innovation outputs (48<sup>th</sup> rank) than innovation inputs (75<sup>th</sup> rank). Ukraine performs best in Knowledge and technology outputs (36<sup>th</sup> rank) and its weakest performance is in Market sophistication (102<sup>nd</sup> rank).

Among the 36 lower middle-income group economies Ukraine ranks 4<sup>th</sup>. Ukraine performs above the lower-middle-income group average in six pillars: Institutions; Human capital and research; Infrastructure; Business sophistication; Knowledge and technology outputs; Creative outputs. In general, as a country of lower middle-income group Ukraine performs above expectation on innovation relative to its level of economic development [*Global Innovation Index: Ukraine, 2022*].

The widespread use of ICT created new challenges and threats for countries, such as unauthorized access to computers, malicious software, phishing scams, wireless network attacks, DoS attacks, etc. Therefore, the cybersecurity became indispensable component of information society.

The Global Cybersecurity Index (GCI), published by ITU, assesses the level of cybersecurity in 182 countries. The evaluation is based on five pillars: legal measures (laws and regulations on cybercrime and cybersecurity); technical measures (implementation of technical capabilities through national and sector-specific agencies); organizational measures (national strategies and organizations implementing cybersecurity); capacity development measures (awareness campaigns, training, education, etc.); cooperation measures (partnerships between agencies, firms, and countries).

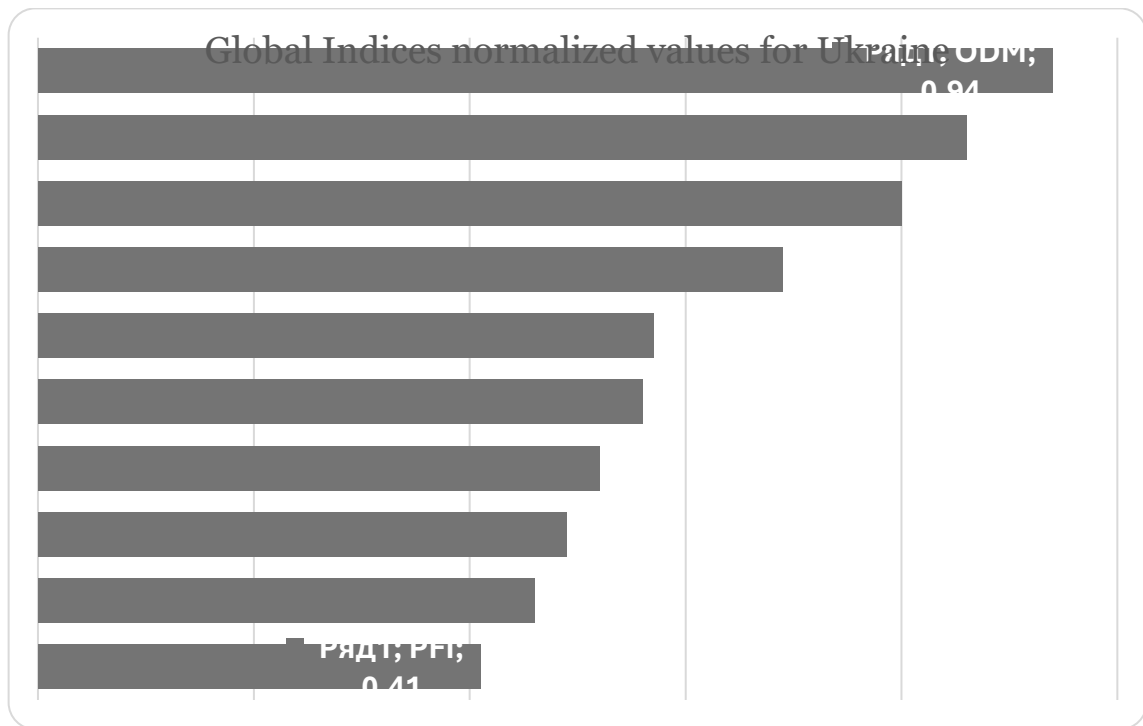
According to Global Cybersecurity Index, in 2020 Ukraine ranked 78<sup>th</sup> with overall score 65,93. Among European countries Ukraine ranked 39<sup>th</sup>. The GCI shows that Ukraine has rather strong position in legal measures (17.46 points out of 20) and weak position in capacity development (10.94 out of 20) and technical measures (11.60 out of 20) [*Global Cybersecurity Index, 2020*].

Another index of cyber security, National Cybersecurity Index (NCSI), developed by e-Governance Academy Foundation (Estonia), measures the readiness of 175 countries to address cyberthreats and to manage cyber incidents. This index helps countries to identify risks and weaknesses in the cyber security system, and to take effective measures to protect themselves from cyber threats.

The NCSI focuses on measurable aspects of cyber security implemented by the central government: cyber security capacities, policies, legislation, established units, cooperation formats, etc.

According to NCSI, in 2021 Ukraine ranked 24<sup>th</sup> with the score 75,32 out of 100. Ukraine has the highest scores in cyber security policy development, protection of essential services, e-identification, protection of personal data and fight against cybercrime. The areas of relative weakness are cyber incident response, crisis management and protection of digital services [*National Cybersecurity Index, 2022*].

Ukraine's ranks in all above-mentioned international indices are presented in the form of a diagram, ranging from the maximum score to the minimum.



**Conclusions.** If we were to download the information society to Ukraine, as we download a file to a computer, we could see a phrase like "more than 50% of the information society has been downloaded" and this is a very encouraging indicator. The study of Ukraine's position in the international rankings of information society development shows that Ukraine is actively developing toward information society. The country has rather strong positions in the access to open data, cyber security and e-government. The number of Internet users and the number of connected households is constantly increasing. Ukraine pays considerable attention to the education, including digital literacy and trainings on the use of ICT.

Although Russia's full-scale war against Ukraine has a serious impact on the development of information society in Ukraine, its consequences are not catastrophic for our country, but it rather becomes a challenge to intensify efforts for the development of information society. In such difficult situation the ICTs are very helpful for ukrainian government as they allow to provide citizens with reliable information, to counter russian propaganda and disinformation as well as to track and promptly respond to emergencies.

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