

# The Unification of Approaches to Measuring the Digital Maturity of Business Structures (International and Domestic Approaches)

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## Abstract

The current state of digital technologies in domestic business is drastically different from the world's one. The use of international methodologies to determine the level of digital maturity of business using appropriate indicators is not acceptable for domestic realities due to the low overall level of use of digital technologies in the economic space. The task of developing a national methodology for determining the index of digital maturity of business is relevant and important. Such a methodology should take into account the current state of the national economy, reflect an in-depth analysis of digital maturity indicators of business structures and take into account their dynamics, while being flexible to respond quickly to new economic processes and phenomena, and provide further unification with international methodologies (e.g. DESI). The article analyzes the international approaches to measuring the digital maturity of business structures, and offers its own national methodology for determining the index of digital maturity of business developed on its basis.

## Keywords

Digital Transformation, Digital Maturity, Digital Tools, Business-structures, Digital Maturity Index (HIT)

## 1. Introduction

The world economy has undergone profound changes due to the existence of diverse external influences and the multi-elemental internal structure. The European Union is systematically digitizing its economy, expecting the growing global impact of advanced technologies and growing profits from e-commerce, data exchange and services. The realities of the global world determine precisely such conditions for modernizing the economy and creating clear rules for a new era of innovation. The key issue is digital adaptation and business transformation. The current state of implementation of digital technologies in domestic business differs significantly from the world. Due to the low general level of digitalization of the domestic economic space, the use of international methodologies for measuring the digitalization of business is not acceptable. Calculation, analysis, and further bringing to world standards of the National Index of Digital Maturity of Business on the basis of real indicators will serve as a driver for further practical steps to improve their digital development in order to bring to a new competitive level.

## 2. Digital Scoreboard of the European Community

The main tool for assessing the development of the digital economy and society in the EU is the so-called digital scoreboard, which consists of more than 150 indicators reflecting various aspects of digital development, including Internet penetration, digital skills development, digitalization of

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business and public services. The source of data for the formation of this digital scoreboard is a survey of statistical services of the European Commission (Eurostat and DG CNECT) on the use of information and communication technologies (ICT) among households and enterprises of various forms of ownership. Data are also collected from special studies launched by the European Commission. Such data are collected both for domestic purposes and for reporting to international organizations, such as UNESCO, UNCTAD, the World Bank, Eurostat. However, the specific set of indicators of the digital scoreboard changes periodically in order to adequately reflect the latest trends in the field of digitalization and the general use of information and communication technologies (ICT).

Based on the digital scoreboard, two key reports on the state of the digital economy in the EU are generated. They are the Digital Economy and Information Society Index (DESI) and the European Digital Progress Report (EDRP). The difference between them is that EDRP focuses more on the digital development of an individual country, namely the changes in legislation and others. Both digital scoreboard data and national legislation are used. At the same time, DESI provides a generalized view of digital development in the EU member states based on mainly statistical data and covers information on the following aspects: Internet access, digital skills, integration of digital technologies, use of the Internet, digital public services. The most important requirement for this data is compliance with EU standards to ensure correct comparisons and coordinated decisions at the level of the European Commission and national governments. It should be noted that in the EU countries, in addition to the above indicators, separately analyze indicators that characterize the scientific support of digital technology, including the dynamics of research and development (R&D) in ICT, the number of projects of the EU Framework Program for Research and Innovation, like “Horizon 2020” and others. As for other digitization indicators (those that are not used directly for DESI calculation), some of them are being revised today.

The main indicators for assessing the development of the digital economy in the EU are a number of global indices. Based on certain statistical methodologies and observations they reflect the level of development of the digital economy in different countries. Among such tools, we can single out the most global (Table 1).

**Table 1**

List of global statistical indices that reflect the level of digital development of the country

| #  | Methodology Title  | Ukraine's Position in 2018 |
|--|--|----------------------------|
| Group I indices: reflect the general level of development of the country                                       |  |                            |
| 1  | Global Competitiveness Index (GCI (WEF) [1]                    | 81 (137)                   |
| 2  | Global Innovation Index (GII) [2]                              | 43 (126)                   |
| Group II indices: reflect the level of technical infrastructure for effective business and country development |  |                            |
| 3  | Networked Readiness Index (NRI (WEF) [3]                       | 64 (139)                   |
| 4  | Broadband Penetration Index (ITU) [4]                          | -                          |
| Group III indices: reflect the level of digital development of the country                                     |  |                            |
| 5  | World Digital Competitiveness (WDC) ranking [5]                | 58 (63)                    |
| 6  | ICT Development Index – IDI [6]                                | 79 (174)                   |
| 7  | Index of digitalization of the economy BCG (e-Intensity) [7]   | -                          |
| 8  | Digital Evolution Index – DEI [8]                              | 62 (90)                    |
| 9  | European Digital Progress Report [9]                           | -                          |
| 10   | Digital Economy and Society Index (DESI, IDESI (EU) [10]       | -                          |
| Group IV indices: reflect the level of digital business development  |  |                            |
| 11   | Dell Technologies Digital Transformation Index (DT Index) [11] | -                          |
| 12   | IDSME index evaluation of SMEs digitalization [12]             | -                          |

Note: structured by the authors

Our country is not included in a number of ratings, however, declares a plan for implementation in the relevant rating systems in the near future and predicts the leading positions.

### 3. Global Statistical Indices of the Level of Country's Digital Development

#### 3.1. Group I Statistical Indices

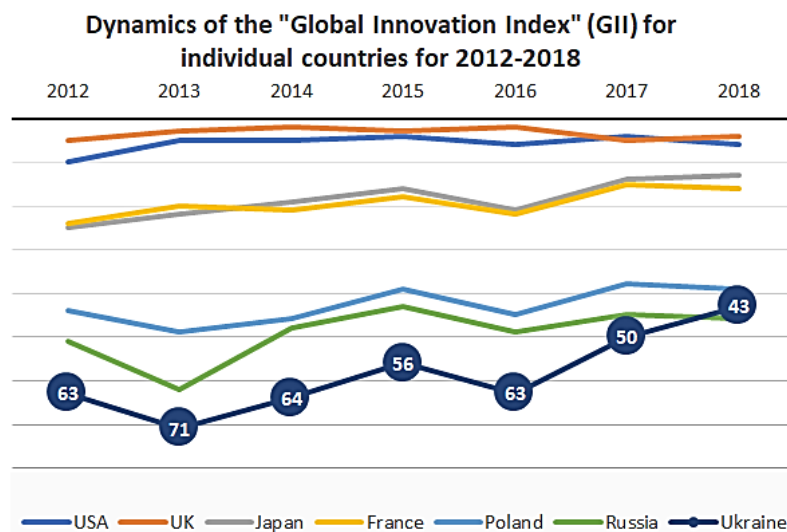
In-depth analysis of metrics for assessing the digital transformation of business structures will help to develop proposals for the development of methods for assessing the digital development of domestic business structures.

Group I indices include Global Competitiveness Index (GCI (WEF) and Global Innovation Index (GII). Global Competitiveness Index (GCI (WEF) consists of 113 variables that detail the competitiveness of countries around the world at different levels of economic development. The set of variables comprise two-thirds of the results of a global survey of company executives (to cover a wide range of factors influencing the business climate in the countries studied), and one-third of publicly available sources (statistics and research organizations).

All variables are combined into 12 benchmarks that determine national competitiveness in diversified areas (quality of institutions; infrastructure; macroeconomic stability; education; etc. They, in turn, are grouped into three sub-indices according to three main stages of development: basic requirements, efficiency enhancers, innovation factors and complexity. Among 137 countries, in 2018 Ukraine ranked 81st.

One more global index that is included in group I indices (Table 1) and which is worth analyzing is Global Innovation Index (GII). The global innovation ranking of the world's countries is compiled annually by Cornell University, the INSEAD School of Business and the World Intellectual Property Organization. It consists of 80 indicators, and 126 countries are evaluated in reference to this index. The Global Innovation Index is based on two sub-indices: the Innovation Contribution Index and the Innovation Issue Index. Both subindexes are calculated as simple averages of their structural components.

The trend of the value of the corresponding index in the dynamics of 2012 - 2018 reflects the effective innovative changes in the development of our country (see Figure 1).



**Figure 1:** Comparison of GII dynamics for individual countries of the world and Ukraine for the period 2012-2018 (obtained by the authors on the basis of Global innovation index data, 2018)

In 2018, Ukraine took 43rd place, which is 7 steps higher than in 2017. Ukraine demonstrates the highest indicators of innovation in education and science (43rd place in the ranking) and business (46th place in the ranking). It should be noted that institutions and infrastructure remain the least innovative (107th and 89th place in the ranking, respectively).

### 3.2. Group II Global Statistical Indices

Group II indices (Table 1) reflect the state of infrastructure for the effective development of the economy, including its digital component.

Networked Readiness Index, NRI (WEF) is used to assess the driving factors and the impact of network readiness and ICT capabilities in a particular country. This takes into account the equal legal role and responsibility of all “team members” of society, i.e, individuals (public), business and government. The Network Readiness Index consists of four sub-indices that assess the environment for ICT development, society's readiness to use ICT, the actual use of ICT by the state, business and the population, as well as the consequences of ICT in the economy and society.

Regarding Ukraine’s ranking, the country failed to demonstrate high positions in the Network Readiness Index. Weak positive dynamics occurred only due to changes in the values of the Index, caused primarily by changes in the structure of the methodology, but not supported by fundamental changes in the development of information and communication technologies in the country. The lag behind the components of the use of technology by the public, business and government (88th place) is the main reason for Ukraine's low results in the world rankings. According to the components of the relevant sub-index, this is reflected in the following way: public use (76th place), business use (63rd place) and government use (82nd place).

The next index of this group is Broadband Penetration Index (ITU). In addition to high speed, broadband access provides a continuous connection to the Internet (with-out the need to establish a dial-up connection) and the so-called “two-way” connection, i.e. the ability to both receive (“download”) and transmit (“unload”) information at high speeds. Ukraine's position is at the bottom of the pile and needs to be improved (Table 2).

**Table 2**

Values of indicators that characterize the level of use of broadband Internet access in Ukraine

| # | Indices   | Explanation |
|---|---|-------------|
| 1 | List of national broadband policies (2018)                          | none        |
| 2 | Percentage of people who use the Internet (2018)                    | 53.0 %      |
| 3 | Fixed broadband subscriptions per 100 inhabitants of Ukraine (2019) | 16.16 %     |
| 4 | Mobile broadband subscriptions per 100 inhabitants (2019)           | 41.7 %      |

Note: structured by the authors

### 3.3. Group III Global Statistical Indices

Group III indices, which reflect the level of digital development of the country, comprise: World Digital Competitiveness (WDC) ranking; ICT Development Index – IDI; Boston Consulting Group (e-Intensity); Digital Evolution Index – DEI; European Digital Progress Report; Digital Economy and Society Index (DESI, IDESI (EU)).

World Digital Competitiveness (WDC) ranking (since 2016) complements the overall rating Global Competitiveness Index (GCI). This index reflects the effective-ness of the efforts that have been invested in the development of the digital economy, as well as reflects the effects of the contribution of digital technologies on the efficiency of the country and provides an opportunity to assess and manage digital transformations. Ukraine's position in this ranking is 58 out of 63 countries which were surveyed in this study.

ICT Development Index (IDI) calculated by the International Telecommunication Union (ITU) since 2009. Initially IDI took into account 11 indicators, grouped into sub-indices for the three groups of processes: access to ICT (e.g. number of mobile contracts per 100 citizens, volume of international Internet traffic per capita), use of ICT (e.g. share of Internet users), skills to work with ICT (for example, coverage of the population with higher education, %). However, in 2018, the index was supplemented by three new indicators, such as: subscriptions to mobile broadband Internet traffic, the percentage of mobile phone owners and the percentage of people with information and

communication technology skills. The IDI index is designed to monitor the development of IT in countries and their position in the global IT market; measuring progress in ICT development in both developed and developing countries; identifying the digital divide; identifying the potential of ICT development and the level to which countries can use it to increase their own growth and development. However, this method, according to the authors, does not allow to comprehensively assess the level of digital transformation of the economy in the country, as it evaluates mainly technical parameters, thus identifying the development of the digital economy with the level of ICT infrastructure and preparedness. Tufts University, in cooperation with Mastercard, has developed a Digital Evolution Index (DEI) which ranks countries based on their progress in digital development. The DEI includes 90 countries evaluated across over 100 different indicators. In 2019, Ukraine took 62nd place.

The Digital Economy and Society Index (DESI) include many parameters which give a fairly complete picture of the state of digitalization of the EU. The DESI report was first published in 2014. In Table 3 the weights of the main DESI factors adopted in the framework of EU digital policies are presented.

**Table 3**

The weights of the main factors of DESI

| # | Dimension                               | Weight |
|---|---|--------|
| 1 | Connection (C)                          | 25%    |
| 2 | Human resources (H)                     | 25%    |
| 3 | Use of Internet services (I)            | 15%    |
| 4 | Integration of digital technologies (T) | 20%    |
| 5 | Digital public services (P)             | 15%    |

Note: structured by the authors

For each country, the index *DESI* is calculated by the formula

$$DESI (Country) = 0.25 C + 0.25 H + 0.15 I + 0.2 T + 0.15 P. \quad (1)$$

Indicators C (Connection) i H (Human resources) reflect the general infrastructural state of the digital economy and society, so they are given the most weight. The Digital Integration (T) factor is also given high weight, as this indicator captures the use of the first indicator, namely the use of ICT in the business sector, which is one of the most important factors in the growth of the country's economy. "Use of Internet services (by citizens)" (I) and "Digital public services" (P) are provided by the quality of the first factor, namely the infrastructure.

Each of the subfactors is assigned with weight estimates that in total for each factor are equal to 100 % (Table 4).

**Table 4**

Weight distribution for DESI subfactors

| #  | Subfactor                       | Weight | #  | Subfactor                               | Weight |
|----|---------------------------------|--------|----|---|--------|
| 1  | Connection (C)                  |        | 3  | Use of Internet Services (I)            |        |
| 1a | Fixed broadband connection      | 20%    | 3a | Content                                 | 33%    |
| 1b | Mobile broadband                | 30%    | 3b | Communications                          | 33%    |
| 1c | Fast broadband connection       | 20%    | 3c | Operations                              | 33%    |
| 1d | Ultra fast broadband            | 20%    | 4  | Integration of Digital Technologies (T) |        |
| 1e | Broadband Price Index           | 10%    | 4a | Business digitization                   | 60%    |
| 2  | Human Resources (H)             |        | 4b | E-commerce                              | 40%    |
| 2a | Main skills and usage           | 50%    | 5  | Digital Public Services (P)             |        |
| 2b | Advanced skills and development | 50%    | 5a | E-government                            | 80%    |
|    |                                 |        | 5b | E-health                                | 20%    |

Note: structured by the authors

When it comes to integrating digital technologies into the business sector, the dimension of business digitization is more important than e-commerce, its weight is 0.6.

The greatest difficulties arise with the collection of data from the Business Digitization group, as businesses are not always willing to disclose business results.

In order to understand how the emergence of new digital technologies is integrated into the business sphere, it is necessary to carry out in-depth monitoring of indicators of this group (Table 5).

**Table 5**

Criteria dynamics of for assessing the index of digital maturity of business in the period 2015 – 2019 in EU countries

| #  | 2015   | 2016   | 2017   | 2018   | 2019   |
|----|--|--|--|--|--|
| 1  | Businesses where more than 50% of people used computers with Internet access for commercial purposes   | Businesses where more than 50% of people used computers with Internet access for commercial purposes   | Businesses where more than 50% of people used computers with Internet access for commercial purposes   | Businesses where more than 50% of people used computers with Internet access for commercial purposes   | Businesses where more than 50% of people used computers with Internet access for commercial purposes   |
| 2  | They mainly use their own ICT specialists or the services of outsourcing specialists   | They mainly use their own ICT specialists or the services of outsourcing specialists   | Own ICT specialists *  | Own ICT specialists  | Own ICT specialists  |
| 3  | High-speed broadband Internet (30 Mbps or higher)  | High-speed broadband Internet (30 Mbps or higher)  | High-speed broadband Internet (30 Mbps or higher)  | High-speed broadband Internet (30 Mbps or higher)  | High-speed broadband Internet (30 Mbps or higher)  |
| 4  | Mobile Internet devices for at least 20% of employees (for business communication);  | Mobile Internet devices for at least 20% of employees (for business communication);  | Mobile Internet devices for at least 20% of employees (for business communication);  | Mobile Internet devices for at least 20% of employees (for business communication);  | Mobile Internet devices for at least 20% of employees (for business communication);  |
| 5  | Have a website   | Have a website   | Have a website   | Have a website   | Have a website   |
| 6  | Website with complex functions (description of goods or services, price lists; ability for visitors to customize or develop online goods or services; tracking or status of placed orders; personalized content for regular / recurring visitors | Website with complex functions (description of goods or services, price lists; ability for visitors to customize or develop online goods or services; tracking or status of placed orders; personalized content for regular / recurring visitors | Website with complex functions (description of goods or services, price lists; ability for visitors to customize or develop online goods or services; tracking or status of placed orders; personalized content for regular / recurring visitors | Website with complex functions (description of goods or services, price lists; ability for visitors to customize or develop online goods or services; tracking or status of placed orders; personalized content for regular / recurring visitors | Website with complex functions (description of goods or services, price lists; ability for visitors to customize or develop online goods or services; tracking or status of placed orders; personalized content for regular / recurring visitors |
| 7  | Social media usage   | Social media usage   | Social media usage   | The website has a link with a transition to the profile of social networks of the enterprise *   | 3D printers usage*   |
| 8  | There is an ERP software package for exchanging information between different functional areas   | Purchase of medium-high services of telephone centers (call service)*  | There is an ERP software package for exchanging information between different functional areas *   | Purchase of medium-high services of telephone centers (call service)*  | Purchase of medium-high services of telephone centers (call service)   |
| 9  | Have CRM system  | Sending B2BG electronic invoices (automated processing)*   | Have CRM system *  | Sending electronic invoices (automated processing)*  | Sending electronic invoices (automated processing)   |
| 10 | Exchange of information (SLM) electronically with suppliers or customers   | Payment for advertising on the Internet *  | Exchange of information on supply chain management electronically with other companies, or suppliers, or customers *   | Payment for advertising on the Internet *  | Use of industrial or service robots (optional)*  |
| 11 | Used any computer network for sale (at least 1%)   | Used any computer network for sale (at least 1%)   | Used any computer network for sale (at least 1%)   | Used any computer network for sale (at least 1%)   | Used any computer network for sale (at least 1%)   |
| 12 | E-commerce (companies that have a turnover of web sales, more than 1% of total sales and more than 10% of B2C web sales of total sales on the Internet)  | E-commerce (companies that have a turnover of web sales, more than 1% of total sales and more than 10% of B2C web sales of total sales on the Internet)  | E-commerce (companies that have a turnover of web sales, more than 1% of total sales and more than 10% of B2C web sales of total sales on the Internet)  | E-commerce (companies that have a turnover of web sales, more than 1% of total sales and more than 10% of B2C web sales of total sales on the Internet)  | Analysis of big data from any data source (optional)   |

Note: \*The changes are traced in comparison with the previous year; structured by the authors

A score scale from 0 to 12 was set for the evaluation and monitoring of enterprises according to the Digital Maturity Index.

It should be noted that only one-fifth of companies in the EU have a high level of Digital Maturity Index. However, these results are diversified. Thus, in Denmark more than half of companies have high digital maturity; on the contrary, in Bulgaria and Romania, the share of companies working on digital transformation is less than 10% (Eurostat community survey ICT usage and e-commerce in enterprises, 2019).

In Table 6 data on the degree and speed of penetration of digital technologies into the business of EU countries are given. It can be noted that social media, electronic bills, mobile applications and high-speed broadband are the driving force for the digital transformation of European businesses.

**Table 6**  
The speed of penetration of digital technologies in the business of the EU in 2018

| Key indicators that reflect the processes of digital transformation | % EU businesses |                  | Compared to 2016 year % |                  |
|---|-----------------|------------------|-------------------------|------------------|
|   | large           | medium and small | large                   | medium and small |
| Having a website or home page                                       | 94%             | 77%              | 0                       | 0                |
| The website has some interactive features                           | 74%             | 57%              | 0                       | -1               |
| Use social networks   | 72%             | 47%              | 9                       | 8                |
| >50% employees use computers and the Internet                       | 52%             | 43%              | 2                       | 3                |
| The fastest broadband connection is at least 30 Mbps                | 75%             | 43%              | 6                       | 5                |
| Use ERP software (enterprise resource planning)                     | 76%             | 33%              | impossible to compare   |                  |
| Use customer relationship management information system (CRM)       | 62%             | 32%              | 0                       | 1                |
| > 20% employees with portable devices for commercial use            | 42%             | 34%              | 3                       | 2                |
| Use the services of ICT specialists                                 | 75%             | 18%              | -3                      | -1               |
| Online sales (at least 1% of turnover)                              | 38%             | 17%              | -1                      | -1               |
| Exchange data of electronic supply chain management                 | 47%             | 17%              | -1                      | 1                |
| Electronic sales in the sector (B2C) business consumer              | 9%              | 7%               | 1                       | 1                |

Note: grouped by the authors

Cloud computing also provides high growth rates, but so far only in large enterprises. Large companies are more digital than small and medium-sized businesses.

The main advantages of the DESI index are:

1. Evaluation of the effectiveness of digitization processes: obtaining a general description of the effectiveness of digitization;
2. Evaluation of dissemination: identification of areas in which the effectiveness of digitization processes can be improved based on the analysis of the evaluation of the components of the index, individual indicators and the development of appropriate management measures.
3. Forecasting further action: assessment of progress over time (dynamics of changes in index values).
4. Comparative analysis: clustering of countries taking into account the values of their indices, comparison of countries at similar stages of digital development in order to identify the need for improvement in relevant policy areas.

However, there are some disadvantages as well. They are the lack of data on certain parameters in some countries (in this case, based on data from the previous period, proxy indicators to identify trends for the compilation of time series); the national specifics of digitization processes are not taken into account. Each country has its own parameters and features of the process of digital transformation. There is no survey of microbusiness, which can make significant changes in the development of the country's economy.

### 3.4. Group IV Global Statistical Indices

The fourth group of indices include Dell Technologies (DT Index) and IDSME index evaluation of SMEs digitalization (Table 1).

Index of digital transformation Dell Technologies (DT Index) is a global ranking that indicates the status of digital business transformation. In July-August 2020, Dell Technologies entered into a partnership with independent research firm Vanson Bourne which surveyed 4,300 business leaders – medium-sized and large organizations in 18 countries and generated a global report showing the status of business transformation.

The definition of «IDSME index evaluation of SMEs digitalization» covers companies of different sizes and different areas in three countries: Russia, Serbia and Slovakia. The index has two sub-indices: 1) The use of digital technologies, consisting of eight indicators (the presence of SMEs own website, accounts in social networks, the use of business models B2B and B2G, cloud computing, decision-making tools; 2) E-commerce, which includes online sales; e-commerce turnover; and cross-border online sales.

## 4. Indexation of Digital Maturity of Business in Ukraine

As Ukraine is not reflected in many global rankings for the development of the digital economy, there is a problem with understanding the general trend of change in the domestic digital infrastructure and its position in the global digital context. One of the main reasons for this phenomenon is the practical lack of information field, roadmaps for business that would recommend and inform businesses about certain digital benefits and opportunities. Also imperfect and technologically outdated is the methodology for obtaining statistical data on the digital development of business structures and the digital economy of the country.

The main source of data in our country is the State Statistics Service of Ukraine which collects data from the developed unified form (# 1-ICT (annual) "Use of information and communication technologies in enterprises in 20\_") (Appendix B) [13].

In 2017 Ukraine took as a basis the European form of statistical surveys "Community survey on ICT usage and E-commerce in enterprises" [14] to fill the fourth component (Integration of digital technologies) of the DESI index.

Declared in the government "Concepts for the development of the digital economy and society of Ukraine for 2018-2020" measures to stimulate the economy and attract investment, overcome digital inequality, deepen cooperation with the EU in the digital sphere and build the country's innovation infrastructure and digital transformation [15] not fully implemented, but the government of our country declares the following plans for the positions of our country in the global rankings (Table 7).

**Table 7**

Projected positions of our country in global rankings in 2025

| # | Indicator                                       | Rating Position |      |      | Increase since 2016     |
|---|---|-----------------|------|------|-------------------------|
|   |   | 2016            | 2020 | 2025 |                         |
| 1 | Digital Economy and Society Index 2025 (EU)     | -               | 20   | 20   | Inclusion in the rating |
| 2 | Global Innovation Index 2025 (GII, INSEAD WIPO) | 56              | 40   | 15   | 41                      |
| 3 | Networked Readiness Index 2025 (WEF)            | 64              | 30   | 20   | 44                      |
| 4 | Broadband Penetration Index 2025 (ITU)          | -               | -    | 20   | Inclusion in the rating |
| 5 | Global Competitiveness Index 2025 (WEF)         | 85              | 60   | 20   | 65                      |

Note: grouped by the authors

It should be noted that in order to be able to integrate Ukraine into the relevant global indices, it is necessary to first unify the groups of statistical indicators, taking into account the differences in the national specifics of digitization processes and their measurement.







Ukraine started the process of monitoring the DESI index in 2013, when a national system of information society indicators was created (an informatization agency has existed in Ukraine since the mid-1990s). With the creation of the State Agency for e-Government, some functions related to the development of the information society were abolished. The establishment in August 2019 of the Ministry of Digital Transformation of Ukraine and the position of Deputy Prime Minister, who is responsible in the government for the policy of informatization and development of digital technologies, opened new opportunities for monitoring digitalization processes in Ukraine. The National Concept and the relevant government action plan within it have been developed, but due to the slowdown in the process of reforming the national economy, this Concept is likely to be revised in the near future. Back in 2018, under the auspices of the Ministry of Economic Development and Trade, a working group was established to develop a new system of indicators for the DESI index which was to be based on the EU DESI system. However, the work of this group proved to be ineffective, mainly due to a lack of interagency coordination between government agencies. Each agency had its own proposals for reforming the statistical system and these proposals were insufficiently aligned with the key player's plans for collecting data in Ukraine which is the State Statistics Service of Ukraine.

## 5. Digitization of the National Statistical System as an Important Step towards the Development of the Digital Economy

Official statistics do not calculate the size of the digital economy in Ukraine, which makes it impossible to track progress in the process of its digitalization. Today, only the digital economy is measured in the narrow sense (information and computer services) [16]. Hi-tech products, digitalized services, etc. are not accounted for. A comparison of national statistical systems on the technological capabilities of information collection and processing is shown in Table 8. Estonia and Singapore are leaders in digital transformation.

**Table 8**

Comparison of technological capabilities of national statistical systems

| Indicator for comparison  |  Ukraine |  Estonia |  Singapore |  EU |
|---|---|---|---|--|
| number of available statistical subcategories                                     | 96  | 112   | 161   | 226  |
| data sources used in statistics   | surveys, censuses, reports of enterprises, government agencies                              | surveys, censuses, reports of enterprises, government agencies                              | surveys, censuses, reports of enterprises, government agencies                                  | surveys, censuses, reports of enterprises, statistical services of member countries      |
| available formats for uploading ready-made data                                   | doc, pdf, xls   | xls, csv, xml, json, pc-axis  | xlsx, pdf, csv, html, tab delimited   | xls, pdf, csv, tsv, html, spss, pc-axis  |
| perfection of methods of calculation of GDP (according to the Data Quality Index) | 75  | 89  | 93  | 89   |
| availability of microdata (detailed data for scientific activity)                 | ✗   | ✓   | ✓   | ✓  |
| ability to work with data (modifications, graphs, own indicators)                 | ✗   | ✓   | ✓   | ✓  |
| indicators prediction   | ✗   | ✗   | ✗   | ✓  |
| open API availability   | ✗   | ✗   | ✓   | ✓  |

The document of the Ministry of Digital Transformation of Ukraine "Audit of the Development of the Digital Economy" (02.2021) in the process of integration with the international DESI has declared digital projects which are reflected in Table 9. The terms given in the table are debatable.

It is worth mentioning that in order to take into account the specifics of the national economy, the list of DESI indicators must be developed by the State Statistics Service of Ukraine in cooperation with other executive bodies and approved by the government. Only after that the State Statistics Service will be able to change its statistical questionnaires (forms) and conduct the necessary specialized surveys.

**Table 9**  
Digital Projects

| Title  | Projects  | Estimated budget (thousand euros) | Time of realization (months) |
|--|---|-----------------------------------|------------------------------|
| Strategic level 7: Statistics, integration with international DESI | Research on the selection of indicators of digital development (all indicators are in rapid diagnostics)  | 63-77                             | 2                            |
|  | Project "Reorganization of the statistics system, development of models and prototypes of national digital statistics and models of each individual component of the digital economy". Package of normative documents, institutionalization (state statistics system) | 252-308                           | 6-12                         |
|  | Project "National Index of Digital Economy Development"   | 144-176                           | 12                           |
|  | Project "Integration of National Rating Data with the International Index of Development of Digital Economy and Society DESI (International DESI, EU)"  | 31-39                             | 2                            |

Further research on the state of digitalization indicators in Ukraine should be conducted in three main areas: 1) development of recommendations for the adaptation of statistical indicators to EU standards; 2) development of methods for conducting specialized surveys in the field of digitization statistics; 3) justification of the use of available indicators that do not fully meet EU standards, but reflect important processes related to digitalization in the national economy [17]. The conducted analysis of the indicators of DESI for Ukraine in the framework of the project HIQSTEP («High Quality Short-term Studies to Support Activities under the Eastern Partnership») testified that without changes in the existing national statistical system it is impossible to calculate about 50% of the components of the index.

## 6. The Importance of Digitalization of Micro and Small Businesses

At the forefront of large-scale digitalization of national economies are large enterprises. However, in fact, the basis of economic and social well-being both in Ukraine and in the countries of the European Union are small and medium enterprises [18], which comprise more than 99.5% of the total number of enterprises in the EU, where more than 66% of workers are robot suppliers and bring about 60% of value added to the total budget (see Figure 2). Small and medium business in Ukraine occupies a significant part of the economy: it generates 47.2 percent of total value added, and the level of employment of the population aged 15-64 is 61.4 %.

Therefore, special attention should be paid to effective digital support and digital promotion of small business, both at the European and national levels [19].

In Table 10 the main reasons why Ukraine should take into account the EU practice in developing a methodology for collecting and processing statistical information, and the peculiarities of developing a domestic methodology for determining the index of digital business transformation are singled out.

| Class size   | Number of enterprises |                |                | Number of persons employed |                |                | Value added   |                |                |
|--------------|-----------------------|----------------|----------------|----------------------------|----------------|----------------|---------------|----------------|----------------|
|              | Ukraine               |                | EU-28          | Ukraine                    |                | EU-28          | Ukraine       |                | EU-28          |
|              | Number                | Share          | Share          | Number                     | Share          | Share          | Million €     | Share          | Share          |
| Micro        | 1 506 916             | 95.9 %         | 92.9 %         | 2 419 700                  | 34.1 %         | 29.4 %         | 10 243        | 15.4 %         | 20.5 %         |
| Small        | 52 821                | 3.4 %          | 5.9 %          | 984 900                    | 13.9 %         | 20.2 %         | 8 485         | 12.7 %         | 17.6 %         |
| Medium-sized | 9 500                 | 0.6 %          | 1.0 %          | 953 400                    | 13.4 %         | 16.9 %         | 12 681        | 19.0 %         | 18.1 %         |
| <b>SMEs</b>  | <b>1 569 237</b>      | <b>99.9 %</b>  | <b>99.8 %</b>  | <b>4 358 000</b>           | <b>61.4 %</b>  | <b>66.5 %</b>  | <b>31 411</b> | <b>47.2 %</b>  | <b>56.3 %</b>  |
| Large        | 2 347                 | 0.1 %          | 0.2 %          | 2 739 800                  | 38.6 %         | 33.5 %         | 35 180        | 52.8 %         | 43.8 %         |
| Total        | <b>1 571 584</b>      | <b>100.0 %</b> | <b>100.0 %</b> | <b>7 097 800</b>           | <b>100.0 %</b> | <b>100.0 %</b> | <b>66 591</b> | <b>100.0 %</b> | <b>100.0 %</b> |

Figure 2: Data for 2017 provided by the State Statistics Service of Ukraine and Eurostat

Table 10

Features of development of the domestic methodology for determining the index of digital business transformation taking into account the European experience

| # | Reasons why Ukraine should take into account the EU practice of collecting statistics («Community survey on ICT usage and E-commerce in enterprises»)   | Disadvantages that are not taken into account in 1-ICT (annual) "Use of information and communication technologies at enterprises in 20__"  | The reasons for the need to develop their own methodology for determining the index of digital business transformation   |
|---|---|---|--|
| 1 | EU countries primarily motivate business structures to use the latest digital technologies. They have created an appropriate ecosystem in which everyone uses IT infrastructure (education, business, government, medicine, etc.) | Do not conduct surveys and data collection of micro-enterprises. It is micro enterprises (including startups) that use digital technologies immediately at the start of their business and thus function effectively. | As the Digital Economy and Society Index (DESI) measures the progress of EU countries towards the digital economy and society, it is necessary to take into account that Ukraine is at different stages of digital development compared to EU countries. |
| 2 | Every year the form is revised and modified according to the most relevant and important technologies.  | The gap between the digital literacy of European and domestic business. Not clear terminology and most new technologies.  | A comprehensive assessment of all business entities is required. It is necessary to take into account the current state of digital business transformation.  |
| 3 | Transparency and clarity of the level of development of business structures of a country.   | The unwillingness of domestic business to integrate the technologies of Industry 4.0 without trying the technologies of Industry 3.0.   | Due to the effective use of digital technologies, the gap between the development of SMEs and large entities disappear.  |
| 4 | The data are based on a combination of state and departmental statistics with a system of periodic representative surveys of the population, professional groups and enterprises.   | Use of data from only one source of State Statistics  | Motivating business entities to use new digital technologies.  |
| 5 | -   | -   | Guidelines, information source and ability to determine one's own index of digital transformation and receive recommendations for increasing the level of digital maturity.  |
| 6 | -   | -   | Transparency and clarity of the algorithm for the implementation of relevant technologies in their own business activities for the business entity.  |
| 7 | -   | -   | Eliminating "information inequality" between individual regions, sectors of the economy and different segments of the population   |

Note: structured by the authors

## 7. HIT- index

Based on the above provided analysis, it is necessary to develop own methodology for determining the index of digital business transformation, which would take into account the realities and specifics of the domestic market and reflect an in-depth understanding of the processes of digitalization of the domestic business environment.

In view of this, there has been designed a new approach to the definition of the Index of digital transformation of business structures, which has the characteristics of a complex system "HIT", namely the separation of four levels of groups of indicators, which, in turn, contain a system of subindicators with appropriate weights (see Figure 3). A more detailed argumentation of indicators and their weight coefficients is reflected in [20]

| Index of digital transformation of business organizations   |   |  |
|---|---|--|
| Digital literacy human "H"<br>Digital literacy of human capital (skills and competencies)   | Digital Instruments "I"<br>Groups of digital tools  | Technology "T"<br>Digital infrastructure<br>(hardware, technological support)  |
| 1. Low level of digital literacy (0-0.1).<br>2. Fundamental level of digital literacy (0.11-0.3).<br>3. Intermediate (transitional) level of digital literacy (0.31-0.7).<br>4. Progressive level of digital literacy (0.71-0.9).<br>5. Progressive specialized (0.91-1). | I. Very simple (0-0.1);<br>II. Simple (0.11-0.3);<br>III. Average (0.31-0.6);<br>IV. Complicated (0.61-0.9);<br>V. Very complicated (0.91-1).<br>$k_1^{(I)}=0.09; k_2^{(I)}=0.07; k_3^{(I)}=0.06;$<br>$k_4^{(I)}=0.05; k_5^{(I)}=0.03.$ | 1. Satisfaction with the quality and speed of the Internet (Broadband Internet 30 Mbit / s or higher) (from 0 to 1) ( $k_1^{(T)}=0.5$ ).<br>2. Digital equipment (hardware):<br>2.1. The level of providing jobs with computer equipment (computers, laptops) (from 0 to 1) ( $k_2^{(T)}=0.3$ );<br>2.2. The level of providing employees with mobile Internet devices for work (smartphones with specialized applications) (from 0 to 1) ( $k_3^{(T)}=0.2$ ). |
| $Summ_H = n^{(H)}$<br>$n^{(H)}$ – an indicator of the level of digital literacy of human capital  | $Summ_I = \sum_i n_i^{(I)} \cdot k_i^{(I)}$<br>$n_i^{(I)}$ – an indicator of the level of functioning of digital tools,<br>$k_i^{(I)}$ – weight coefficient of the indicator $n_i^{(I)}$  | $Summ_T = \sum_i n_i^{(T)} \cdot k_i^{(T)}$<br>$n_i^{(T)}$ – an indicator of the level of use of digital technologies;<br>$k_i^{(T)}$ – weight coefficient of the indicator $n_i^{(T)}$  |
| $\omega_H = 0.3$  | $\omega_I = 0.5$  | $\omega_T = 0.2$   |

**Figure 3:** Groups of indicators for determining the Index of digital transformation of business structures

On the basis of the consolidated structural indicators of digital transformation of business organizations the way of definition of the generalized Index of digital transformation of business is developed:

$$HIT = Summ_H \cdot \omega_H + Summ_I \cdot \omega_I + Summ_T \cdot \omega_T \quad (2)$$

where "HIT" – index of digital business transformation;  $Summ_H$  – summary indicator of the state of digital literacy of human capital of the organization; ;  $Summ_I$  – summary indicator of the state of functioning of digital tools integrated into the business processes of the organization;  $Summ_T$  – summary indicator of the state of use of digital technologies for doing business;  $\omega_H, \omega_I, \omega_T$  – weights of indicators  $H, I, T$  respectively,  $\omega_H + \omega_I + \omega_T = 1$ .

The weighting of indicator  $I$  was chosen equal to 0.5 ( $\omega_I = 0.5$ ) because the use and implementation of certain groups of digital tools in the structure of business processes of the organization transform the existing business model of the organization and act as an imperative for innovative development of the organization. The weighting factor of the indicator  $H$  is chosen as 0.3 ( $\omega_H = 0.3$ ) because "Digital" literacy (or "digital" competence) is recognized by the EU as one of the eight key competences for life and professional activity. The weighting factor of the indicator  $T$  is 0.2 ( $\omega_T = 0.2$ ) as a function of the two previous indicators.

The annual assessment of the HIT business digital transformation index would serve as a tool for monitoring and assessing the effectiveness of doing business in the era of the digital economy, helping to identify barriers to the development of small and medium-sized businesses, forming a list of priority economic, legal and regulatory measures (reforms) to improve the implementation of digital technologies in the activities of domestic business structures and would contribute to the integration of domestic business into the digital economy of the world.

## 8. Conclusion

The structure of the national index is proposed, which is inherent in the features of a complex triune system "HIT" with the key, according to the authors, indicators of digital increase in domestic business - human capital, digital instruments and digital technologies. The annual assessment of the HIT index and obtaining reliable data for quantitative and qualitative assessment of the digital potential of enterprises will help identify bottlenecks in the development of digital infrastructure, establish constructive digital cooperation and dialogue between society and the state, timely respond to challenges at all levels of legislative and the executive branch. This, in turn, will contribute to the significant advancement of the domestic economy as a whole, bringing it to a competitive position, strengthening Ukraine's positioning in the global economic and political space.

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