Transformation of financial services industry in conditions of digitalization of economy

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Abstract: Modern global financial development is characterized by the active use of digital technologies in all areas of financial development. This leads to a change in the conditions and form of financial relationships between individual entities, the provision of financial services to the population. The article is devoted to the study of the peculiarities of the transformation of financial services industry under the influence of digitalization of the economy. The object of the study is Ukraine and some EU countries, the study period is 2011-2021. Based on the results of the bibliometric analysis, a generalization of the content and conceptual features of the study of digitalization of the economy was carried out, the most common directions of its analysis and the main directions of the connection of the digitalization of the economy with individual components of the country's development (economic development, cyber security, education and business) were determined. This made it possible to determine the most priority areas of influence of digitalization on the transformation of financial relations. An approach to assessing the level of digitalization of the economy, based on taking into account the values of seven indicators: Index of digitization of the economy and society, Index of implementation of digital technologies, Global index of innovations, Index of network readiness, Index of digitization of the economy, Index of global digital competitiveness, Index of quality of digital life has been developed. A sufficiently high level of digitalization of the economy has been proven in most of the analyzed countries. The average value of the integral indicator of digitalization of the economy ranges from 0.83 to 0.85. Austria (0.99), Lithuania and the Czech Republic (0.91) have the highest values, Ukraine (0.71) has the lowest. With the help of the k-means method, a cluster analysis of countries was carried out according to the integral indicator of digitalization of the economy, and four groups of countries were distinguished. The first cluster includes the countries with the highest average values of indicators of digitalization of the economy, and the fourth - the lowest. In addition, the countries of the first cluster have a significantly higher variation of the components of the integral indicator of digitalization of the economy. The fourth cluster includes countries with more stable values of indicators of digitalization of the economy. Thus, the standard deviation of the values of indicators of digitalization of the economy for the countries of the first cluster varies on average within 3.2-5.5, for the countries of the second cluster - 2.8-4.6, for the third cluster - 2.6-3.9, for the fourth cluster - 2.6-3.9 - 1.4-3.0.

Keywords: financial development, financial services industry, digital economy, cluster analysis, digital competitiveness

JEL Classification: O32, F43, L86, Q57

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1 Academic supervisor – D.S, Associate Professor Inna Tiutiunyk
**Introduction.** Digitization and intellectualization of society are large-scale drivers of the country’s economic growth (Andrushchenko et al., 2022). According to Gartner, 37% of the world's companies have introduced artificial intelligence in their business over the past 4 years, which has increased their turnover by almost 270% (Stamford, 2019). According to the International Federation of Robotics (2023), the robotics market will grow by 175% over the next decade. At the same time, along with a number of advantages, digitalization of the economy also creates additional risks for both the state and business, as well as for individual citizens, including an increase in the vulnerability of personal data, leakage and distortion of information, the emergence of new digital opportunities for cybercrime, threats to databases etc (Ketterer, 2017; Dev, 2006). The low level of digital literacy of the population, as well as the low efficiency of the mechanisms of digital social protection of citizens, the financial resources management system, the processes of automation of the management and control system in the social and economic spheres serve as the basis for the low efficiency of the implementation of strategies for the digital transformation of society and only deepen the destructive processes in the field of digitalization and intellectualization of society (Choung et al., 2023; Prete, 2022). In conditions of active use of digital technologies in all areas of the country's development, socio-economic relations, models of interaction between the state, business and the population are being transformed (Shuaitao & Sun, 2021). The need for the development and subsequent implementation of a road map for the implementation of socio-economic reforms, which would be based on empirically confirmed and statistically substantiated results of economic and mathematical modeling and forecasting of the impact of the level of digitization of society on indicators of the economic development of the country, the quality of life of the population, the level of cyber security, integrity protection, is becoming increasingly urgent financial system and confidentiality of customer data, quality of higher education. The prerequisite for these processes is the assessment of the level of digitization of the economy as a result of the digital transformation of society (Demirgüç-Kunt & Klapper, 2013).

**Literature Review.** One of the driving forces for changing the socio-political and economic environment in the country is the dynamic development of digital technologies and their rapid introduction in all spheres (Vu et al., 2020; Jiang et al., 2021; Xi & Wang, 2023).

On the one hand, digital technologies have a positive effect on indicators of the country's economic development (Hannig & Jansen, 2010; Khan, 2011; Liu et al., 2021; Ozili, 2018; Peterson, 2018; Teng & Ma, 2020; Xie & Liu, 2022), contributes to the increase of labor productivity (Pan et al., 2022), facilitates access to certain types of services for the population (Li et al., 2020; Lin & Zhang, 2022; Malady, 2016), stimulate the transformation of financial service systems (Breidbach et al., 2020; Chen et al., 2017; Zhu & Chu, 2023; Jiang et al., 2021; Gomber et al., 2017), innovation development (Feng et al., 2022; Li et al., 2023) on the other hand - causes the transformation of socio-economic relations in the country, changes in algorithms and models of interaction between the state, business and society, forms additional risks from the point of view of protecting personal data, combating cyber threats and fraud (Charles & Bodanac, 2018; Kan et al., 2022).

Some researchers consider the adoption of digital technologies (broadband Internet, smartphones, Web 2.0, SEO, cloud computing, speech recognition, online payment systems, and cryptocurrencies) as a driver of e-commerce development in the country Verhoef et al. (2021). The further development of innovative digital technologies such as artificial intelligence (AI), blockchain, Internet of Things (IoT) and robotics can have long-term positive effects on business (Ng et al., 2017).

The rapid introduction of digital technologies into all spheres and sectors of economic development (Jain & Gabor, 2020; Barbesino et al., 2005) actualized the need to study their role in the economic, social and political development of the country and to study the content-conceptual and evolutionary-spatial patterns of the development of digital technologies and their impact on the transformation of socio-economic reforms in the country.

For this purpose, a bibliometric analysis of 29,649 scientific publications devoted to issues of digitalization of the economy in publications indexed by the Scopus database will be conducted. The growth dynamics of the number of publications on the digitalization of the economy during 1939-2023 shown in Figure 1 shows the rapid growth of publication activity since 2015. One of the reasons for this situation was the adoption in 2015 of the “Strategy of the EU Single Digital Market”, which consisted in promoting economic growth, increasing the number of jobs, increasing competition, increasing the volume of investments and innovations.
in the EU countries due to three components: facilitating access for consumers and companies to digital goods and services, creation of favorable and equal conditions for the development of digital networks, formation of the potential for the growth of the digital economy.

Figure 1. Trends in publication activity on issues of digitalization of the economy

Source: built by the author using the Scopus database.

If in 2015, 524 publications were published on issues of digitalization of the economy, then in 2023 their number was 5,492.

The first publications devoted to the digitization of the economy were published as early as 1939, and until 1984 they were isolated in nature.

The analysis of publications by country of origin of the authors (Figure 2) showed that the largest number of publications were published by representatives of China (4,608), USA (3,541), Great Britain (2,346) and India (1,614), and the fewest - by countries in Africa and Central America. These trends do not correlate with indicators of the levels of the country's digital development and its digital competitiveness (Table 1).

Thus, it can be concluded that there is no direct connection between the levels of digital development of the country and publication activity on issues of digitization of the economy.

Figure 2. Number of publications on digitalization of the economy by country of origin

Source: built by the author using the Scopus database.
Table 1. Ranking of countries according to the Digital Competitiveness Index

<table>
<thead>
<tr>
<th>Country</th>
<th>2023 rating</th>
<th>2023 score</th>
<th>2022 rating</th>
<th>2022 score</th>
<th>2021 rating</th>
<th>2021 score</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>1</td>
<td>100</td>
<td>2</td>
<td>99.81</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2</td>
<td>98.1</td>
<td>6</td>
<td>97.85</td>
<td>7</td>
<td>93.31</td>
</tr>
<tr>
<td>Singapore</td>
<td>3</td>
<td>97.4</td>
<td>4</td>
<td>99.48</td>
<td>5</td>
<td>95.13</td>
</tr>
<tr>
<td>Denmark</td>
<td>4</td>
<td>96.93</td>
<td>1</td>
<td>100</td>
<td>4</td>
<td>95.16</td>
</tr>
<tr>
<td>Switzerland</td>
<td>5</td>
<td>96.24</td>
<td>5</td>
<td>98.23</td>
<td>6</td>
<td>94.34</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>6</td>
<td>94.8</td>
<td>8</td>
<td>95.2</td>
<td>12</td>
<td>89.72</td>
</tr>
<tr>
<td>Sweden</td>
<td>7</td>
<td>94.12</td>
<td>3</td>
<td>99.81</td>
<td>3</td>
<td>95.19</td>
</tr>
<tr>
<td>Finland</td>
<td>8</td>
<td>94.05</td>
<td>7</td>
<td>96.6</td>
<td>11</td>
<td>90.13</td>
</tr>
<tr>
<td>China</td>
<td>9</td>
<td>93.73</td>
<td>11</td>
<td>94.11</td>
<td>8</td>
<td>92.24</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>10</td>
<td>93.64</td>
<td>9</td>
<td>94.36</td>
<td>2</td>
<td>96.58</td>
</tr>
<tr>
<td>Canada</td>
<td>11</td>
<td>91.98</td>
<td>10</td>
<td>94.15</td>
<td>13</td>
<td>87.31</td>
</tr>
<tr>
<td>UAE</td>
<td>12</td>
<td>88.86</td>
<td>13</td>
<td>91.42</td>
<td>10</td>
<td>90.52</td>
</tr>
<tr>
<td>Israel</td>
<td>13</td>
<td>87.7</td>
<td>15</td>
<td>87.37</td>
<td>17</td>
<td>79.58</td>
</tr>
<tr>
<td>Norway</td>
<td>14</td>
<td>85.96</td>
<td>12</td>
<td>93.23</td>
<td>9</td>
<td>91.29</td>
</tr>
<tr>
<td>Belgium</td>
<td>15</td>
<td>85.95</td>
<td>23</td>
<td>81.34</td>
<td>26</td>
<td>75.25</td>
</tr>
</tbody>
</table>


Analysis of publications on digitalization of the economy by fields of knowledge (Figure 3) shows the interdisciplinary nature of these studies and the close connection of digitalization with different fields of knowledge. Thus, the largest number of publications belongs to the fields of knowledge “Social sciences” - 18%; “Computer science” - 17%; “Engineering” and “Business, management and accounting” - 13%, the smallest – “Arts and humanities” - 2%, “Earth and planetary sciences” and “Mathematics” - 3%.

Thus, the digitalization of the economy is considered in the context of its connection with the economic and social component of the development of society, energy development, the theory of decision-making, the development of information and communication technologies, computer equipment, etc.

Figure 3. Number of publications on digitalization of the economy by field of knowledge

Source: built by the author using the Scopus database.
At the next stage of the research, a bibliometric analysis of publications will be conducted using the VosViewer software. This will make it possible to carry out a substantive and conceptual analysis of the concept of “digitalization of the economy” and to determine the key directions of research into the digitalization of the economy from the point of view of its connection with other components. The results of the analysis presented in Figure 4 allow us to identify 16 clusters of keywords, the main of which are:

- the largest red cluster includes 129 keywords, including: CO2 emissions, green development, environmental pollution, green finance, green innovations, green technologies, low-carbon economy, agriculture, urbanization.
- Thus, within this cluster, digitalization of the economy is viewed as an element of the country's ecological development, decarbonization of the economy, and achievement of sustainable development goals.
- the green (107 keywords) and blue (85 keywords) clusters consider the digitalization of the economy through the prism of the development of digital technologies. The most characteristic keywords within this cluster include: algorithm, automation, big technologies, cybercrimes, digital infrastructure, digital inequality, inclusion, connections, online platforms, technology. Industry 5.0, etc.;
- yellow cluster (84 keywords) – connects the digitalization of the economy and the development of certain sectors of the economy: agriculture 4.0, artificial intelligence, progress in business, database, electronic waste, economic development, food safety, Internet of things;
- lilac (70 keywords) and turquoise (58 keywords) clusters examine the connection between digitalization of the economy and business development: business model, digital innovations, consumers, consumption, crisis management, entrepreneurship, firm productivity, internationalization, supply chain, transfer technology, small business, startup, strategic management, knowledge economy, productivity, key performance indicators;

Figure 4. Content-conceptual analysis of the concept of “digitalization of the economy”
Source: built on the basis of Scopus database data and VosViewer software
the orange (54 keywords) and brown (53 keywords) cluster include keywords that consider the development of the banking sector in the context of digitalization of the economy: digital banking, digital payments, digital technologies, electronic wallet, financial literacy, mobile banking, mobile money, online savings, bitcoin, blockchain, central bank digital currency, cryptocurrencies, digital money, payment systems, security, risk.

− within the framework of the pink cluster (51 keywords), the connection of digitalization of the economy with the development of education and knowledge is considered: digital learning, digital platforms, distance learning, learning, knowledge, online education, cooperation, digital innovations.

− the green cluster includes 46 keywords related to the development of public administration: e-government, public administration, public sector, public services, transparency, politics, etc.

Thus, the results of the bibliometric analysis of the study of digitalization of the economy indicate the interdisciplinary nature of this category and its close connection with individual components of the country's development (economic development, cyber security, education and business). This leads to the need for a more detailed study of the role of digitalization of the economy in the development of certain industries and sectors of the economy, its impact on indicators of the quality of life in society.

**Methodology and research methods.** Determining the level of development of digital technologies serves as a prerequisite for the study of the role of digitalization of the economy in the socio-ecological and economic development of the country. For this purpose, we will conduct a study of the level of implementation of digital technologies in Ukraine and some EU countries for the period 2011-2021. The information base of the study will be data from international rating agencies, the World Bank, the European Commission, and the Organization for Economic Cooperation and Development.

The level of implementation of digital technologies in the country will be determined using the following indicators: Index of digitization of the economy and society (I1), Index of implementation of digital technologies (I2), Global innovation index (I3); Network Readiness Index (I4), Economy Digitalization Index (I5), Global Digital Competitiveness Index (I6), Digital Life Quality Index (I7).

At the first stage of the research, a trend analysis of the values of individual indicators characterizing the level of development and the effectiveness of the introduction of digital technologies in the country will be conducted.

With the aim of a more comprehensive study of the place of Ukraine in terms of the level of digitalization of the economy, at the next stage of the study, an evaluation of the integral indicator of digitalization of the economy will be carried out using the following formula:

\[
IDE_{it} = \left( 1 + \frac{\lambda_{1t}}{1!} + \frac{\lambda_{2t}}{2!} + \frac{\lambda_{3t}}{3!} + \cdots + \frac{\lambda_{nt}}{7!} \right)^{-1}
\]

where \(IDE_{it}\) is an integral indicator of the digitization indicator of the economy of country \(i\) in the period \(t\); \(\lambda_{nt}\) it is the normalized value of the \(n\)th digitization indicator for the period \(t\); \(i!\) – \(i\) factorial.

Cluster analysis of countries based on the integral indicator of digitalization of the economy will be conducted using the k-means method.

**Results**

The dynamics of changes in the Global Digital Competitiveness Index shown in Figure 5 indicate a slight increase in its values for some countries of the world. For example, the Global Digital Competitiveness Index of Lithuania increased from 72.9 in 2020 to 77.23 in 2023, Slovakia – from 53.23 to 58.3, respectively, and the Czech Republic – from 67.45 to 79.42, respectively. At the same time, during the analyzed period, the Global Digital Competitiveness Index of Slovenia and Latvia remained practically at the level of 2020, and in Poland it decreased from 69.233 to 66.53, respectively.
The analysis of the Network Readiness Index allows us to conclude that the values of this indicator have deteriorated for almost all analyzed countries over the past 4 years (Figure 6). Despite the fact that only Ukraine managed to improve its position in the network readiness rating (55.16 in 2023 compared to 49.43 in 2020), the values of this index still remain the lowest among all analyzed countries. For the rest of the countries, the value of the Network Readiness Index is at an average level of 0.5-0.7.

Figure 5. Dynamics of the Global Digital Competitiveness Index

Source: built according to the International Institute for Management Development data (2023).

Figure 6. Dynamics of changes in the values of the Network Readiness Index

Source: built according to the Network Readiness Index data (2023).
Figure 7. Dynamics of the Digital Life Quality Index

Source: built according to the Digital Quality of Life Index data (2023).

An important indicator that characterizes the digital well-being of countries, the degree of development of digital infrastructure and the level of electronic security of citizens is the Index of the quality of digital life. The values of this index testify to the gradual improvement of the level of digital quality of life for all countries (Figure 7).

According to the results of 2023, the highest value among the countries analyzed by us is Austria (0.72), the lowest is Ukraine (0.53). The analysis of the dynamics of changes in the values of this index during 2020-2023 allows us to draw a conclusion about the different nature of its dynamics for the analyzed countries: its significant increase in Romania (0.69 in 2023 compared to 0.58 in 2020), a decrease in Poland (0.66 and 0.72, respectively) and Slovenia (0.61 and 0.67, respectively), and a return to the 2020 level in Slovakia, Latvia.

Based on formula 1, an assessment of the integral indicator of digitalization of the economy of Ukraine and 10 EU countries in 2019-2023 was carried out. The results of the calculations given in Table 2 testify to a sufficiently high level of digitization of the economy in most of the analyzed countries. Austria (0.98 in 2024), Lithuania and the Czech Republic (0.90) have the highest values of the integrated indicator of digitalization of the economy, and Ukraine (0.70) has the lowest. The average value of the integral indicator of digitalization of the economy during the analyzed period ranges from 0.82 to 0.84. In general, during the analyzed period, there was a slight increase in the integrated indicator of digitalization of the economy for only three of the eleven analyzed countries (Czech Republic - +0.05, Romania - +0.06 and Ukraine - +0.07 compared to the indicators of 2019).

Table 2. Dynamics of the integral indicator of digitalization of the economy

<table>
<thead>
<tr>
<th>Country</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>0.97</td>
<td>0.97</td>
<td>0.99</td>
<td>0.96</td>
<td>0.98</td>
</tr>
<tr>
<td>Latvia</td>
<td>0.83</td>
<td>0.82</td>
<td>0.80</td>
<td>0.85</td>
<td>0.82</td>
</tr>
<tr>
<td>Lithuania</td>
<td>0.88</td>
<td>0.88</td>
<td>0.90</td>
<td>0.92</td>
<td>0.90</td>
</tr>
<tr>
<td>Poland</td>
<td>0.88</td>
<td>0.87</td>
<td>0.83</td>
<td>0.82</td>
<td>0.84</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>0.87</td>
<td>0.84</td>
<td>0.87</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td>Hungary</td>
<td>0.79</td>
<td>0.78</td>
<td>0.77</td>
<td>0.82</td>
<td>0.77</td>
</tr>
<tr>
<td>Slovakia</td>
<td>0.76</td>
<td>0.76</td>
<td>0.78</td>
<td>0.81</td>
<td>0.77</td>
</tr>
<tr>
<td>Romania</td>
<td>0.69</td>
<td>0.71</td>
<td>0.74</td>
<td>0.78</td>
<td>0.78</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0.88</td>
<td>0.87</td>
<td>0.84</td>
<td>0.87</td>
<td>0.84</td>
</tr>
<tr>
<td>Italy</td>
<td>0.84</td>
<td>0.83</td>
<td>0.84</td>
<td>0.87</td>
<td>0.83</td>
</tr>
<tr>
<td>Ukraine</td>
<td>0.68</td>
<td>0.62</td>
<td>0.71</td>
<td>0.69</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Source: author's calculations.
At the next stage of the research, using the k-means method, we will conduct a cluster analysis of countries based on the integral indicator of digitalization of the economy. The applied allowed to form four clusters of countries. This made it possible to form clusters of relatively equal size, balanced by the number of countries included in them, while the division into three and five clusters did not allow to reflect all the differences in the digitalization of the economy of all the analyzed countries.

Table 3. Clustering of countries by tax competitiveness indicators based on the k-means method

<table>
<thead>
<tr>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
<th>Cluster 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria, Lithuania, Czech Republic</td>
<td>Latvia, Poland, Slovenia, Italy</td>
<td>Hungary, Slovakia, Ukraine</td>
<td>Romania</td>
</tr>
</tbody>
</table>

Source: summarized based on the author's calculations.

The clustering results presented in Table 3 indicate an approximately equal number of countries within clusters 1-3. According to indicators of digitalization of the economy, Ukraine, Slovakia and Hungary belong to the third cluster. The first cluster includes countries (Austria, Lithuania, the Czech Republic) with the highest economic digitization indices (above 0.9).

For a more detailed analysis of each of the formed clusters, a dispersion analysis of the components of the integral indicator of digitalization of the economy will be conducted (table 4). The average value of indicators of digitalization of the economy is the highest for the first cluster, the lowest for the countries of the fourth cluster. At the same time, the first cluster is characterized by a significantly higher variation of most indicators compared to other clusters. For example, the variation of the Economy and Society Digitization Index (I1) for the first cluster is 12.72 compared to the countries of the fourth cluster (2.42), for the Network Readiness Index (I2) – 25.5 for the first cluster and 8.77 for the second. The standard deviation of the value of indicators of digitalization of the economy for the countries of the first cluster varies on average within 3.2-5.5, for the countries of the second cluster - 2.8-4.6, for the third cluster - 2.6-3.9, for the fourth - 1.4-3.0. Thus, it can be concluded that the fourth cluster is formed from countries with more stable values of indicators of digitalization of the economy.

Table 4. Results of the dispersion analysis of the components of the integral indicator of digitalization of the economy for the formed clusters

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Mean</th>
<th>St. dev</th>
<th>Var</th>
<th>Cluster 1</th>
<th>Indicator</th>
<th>Mean</th>
<th>St. dev</th>
<th>Var</th>
<th>Cluster 3</th>
<th>Indicator</th>
<th>Mean</th>
<th>St. dev</th>
<th>Var</th>
<th>Cluster 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>76.53</td>
<td>3.57</td>
<td>12.72</td>
<td>I1</td>
<td>53.16</td>
<td>2.61</td>
<td>6.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I2</td>
<td>81.78</td>
<td>4.92</td>
<td>24.17</td>
<td>I2</td>
<td>76.10</td>
<td>3.96</td>
<td>15.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>64.55</td>
<td>4.88</td>
<td>23.77</td>
<td>I3</td>
<td>56.08</td>
<td>3.24</td>
<td>10.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I4</td>
<td>66.86</td>
<td>5.05</td>
<td>25.50</td>
<td>I4</td>
<td>58.09</td>
<td>3.36</td>
<td>11.26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I5</td>
<td>69.61</td>
<td>3.24</td>
<td>10.53</td>
<td>I5</td>
<td>48.35</td>
<td>2.38</td>
<td>5.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>I6</td>
<td>80.43</td>
<td>3.75</td>
<td>14.06</td>
<td>I6</td>
<td>55.87</td>
<td>2.75</td>
<td>7.54</td>
<td></td>
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<tr>
<td>I7</td>
<td>66.14</td>
<td>3.98</td>
<td>15.81</td>
<td>I7</td>
<td>61.55</td>
<td>3.21</td>
<td>10.27</td>
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Source: author's calculations.

The graph of the average values of indicators of digitalization of the economy (Figure 8) shows that the distribution of countries was carried out according to the values of all seven indicators of digitalization, with the exception of the fourth cluster.

For all analyzed indicators of digitalization of the economy, there is a significant gap between their average values within each of the formed clusters. Close values of cluster averages for I2 and I7 exist for the fourth and first clusters, for variables I1, I5 and I6 - for clusters 4 and 3. Thus, the assignment of the country to the fourth cluster is based, predominantly, on the values of the Global Innovation Index (I3) and Network Readiness Index (I4).
Thus, the results of the conducted analysis indicate significant differences between the levels of digitization of the economy in different countries and the need for a more detailed analysis of the features of the digital transformation of society, its impact on individual components of the country's development.

Conclusions

According to the results of the bibliometric analysis of the content and conceptual features of the study of digitalization of the economy, the most common directions of its analysis were determined, and four main clusters of the connection between the digitalization of the economy and individual components of the country's development were formed (economic development, cyber security, education and business). This made it possible to determine the most priority directions in the direction of research into the impact of digitalization on the transformation of socio-economic relations.

With the help of economic and mathematical modeling tools, the level of development of digital technologies of Ukraine and individual EU countries was investigated, countries were clustered depending on the capabilities of its components. Four clusters of countries with similar features in the development of digital technologies have been identified. The obtained results can be useful to state regulators from the point of view of determining the most promising and effective directions of the state policy of digitalization of the economy.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

References


