

## UKRAINE'S POSITION IN INTERNATIONAL RANKINGS ASSESSING THE LEVEL OF DIGITAL DEVELOPMENT OF COUNTRIES

### ПОЗИЦІЯ УКРАЇНИ В МІЖНАРОДНИХ РЕЙТИНГАХ ОЦІНКИ РІВНЯ ЦИФРОВОГО РОЗВИТКУ КРАЇН

*In recent years, the utilization of digital technologies and the promotion of a country's digital development have emerged not only as a strategic necessity but also as a key determinant of its competitiveness on the international stage. The article extensively scrutinized the Digital Competitiveness Index, assessing Ukraine's position within the overall index. Additionally, it evaluated the significance of its components, such as knowledge, technology, and future readiness. The subfactors were also analyzed, allowing the identification of strengths and weaknesses in Ukraine's digitization process. Furthermore, the Digital Economy and Society Index and the Ease of Doing Digital Business Index were examined, both of which do not evaluate Ukraine's developmental level according to the specified indicators. Additionally, the ICT Development Index, which has not been evaluated since 2018, was explored. The obtained results could be utilized in constructing a business process transformation strategy, identifying priority areas, opportunities, and obstacles for the integration of digital technologies into enterprise operations.*

**Key words:** Digital development, Digital Competitiveness Index, Digital economy.

*У останні роки цифрові технології стали рушійною силою розвитку ключових сфер життя. Їх впровадження змінює підходи до ведення бізнесу, розвитку освіти, науки, медицини, соціального обслуговування, а також сприяє економічному зростанню, впровадженню інновацій та підвищенню якості життя населенню. Використання цифрових технологій та сприяння цифровому розвитку країни є наразі не лише стратегічною вимогою, але й одним з ключових факторів забезпечення її конкурентоспроможності на міжнародній арені. Міжнародні рейтинги є важливим індикатором досягнень та слабких сторін впровадження цифрових ініціатив в порівнянні з іншими країнами. Аналіз тенденцій розвитку дає можливість проаналізувати зміни, які відбуваються за різними критеріями оцінки впродовж року, що може вплинути на формування державної політики та інвестиційних і трансформаційних стратегій підприємств. Метою статті є аналіз розвитку різних елементів цифрової економіки України для виявлення основних тенденцій, сильних та слабких сторін для визначення перспектив трансформації бізнес-процесів українських підприємств. Поставлена мета зумовила необхідність розв'язання наступних задач: проаналізувати міжнародні рейтинги, які характеризують рівень цифровізації країни; проаналізувати місце України в рейтингу цифрової конкурентоспроможності; розглянути детально субіндекси та субфактори; виділити сильні та слабкі сторони рівня цифровізації України. Серед основних методів дослідження були використані порівняння, статистичний аналіз та декомпозиція. У статті було детально проаналізовано індекс цифрової конкурентоспроможності, проаналізовано місце України в загальному індексі, а також оцінено значення його складових, таких як рівень знань, технологій та готовність до майбутнього. Також було проаналізовано субфактори, що дало можливість виділити сильні та слабкі сторони цифровізації України. Серед сильних сторін можна виділити цифрові/технологічні навички, загальні державні витрати на освіту, відношення учнів до вчителів (вища освіта), дослідниць-жінок, продуктивність НДДКР за публікаціями, інвестиції у телекомунікації, використання великих даних та аналітику. До слабких сторін слід віднести іноземних висококваліфікованих спеціалістів, права на інтелектуальну власність, фінансування технологічного розвитку, банківські та фінансові послуги, кредитний рейтинг країни, венчурний капітал, абонентів мобільного широкосмугового доступу, бездротовий широкосмуговий доступ, передачу знань, публічно-приватні партнерства та пірацтво програмного забезпечення. Також були розглянуті Індекс цифрової економіки та суспільства та Індекс легкості ведення цифрового бізнесу, які не оцінюють рівень розвитку України за виділеними показниками, а також Індекс розвитку ІКТ, який не оцінюється з 2018 року. Отримані результати можуть бути використані при побудові стратегії трансформації бізнес-процесів підприємства з метою виявлення пріоритетних галузей та наявних можливостей та перешкод при впровадженні цифрових технологій у діяльність підприємств.*

**Ключові слова:** цифровий розвиток, Індекс цифрової конкурентоспроможності, цифрова економіка.

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**Introduction.** In recent years, digital technologies have emerged as a driving force for the development of key areas of life. Their implementation is reshaping approaches to conducting business, advancing education, science, medicine, social services, and also fostering economic growth, innovation, and improving the quality of life for the population. The utilization of digital technologies and the promotion of a country's digital development have

become not only a strategic necessity but also one of the key factors ensuring its competitiveness on the international stage.

International rankings serve as important indicators of achievements and weaknesses in the implementation of digital initiatives in comparison to other countries. The analysis of developmental trends allows for scrutinizing changes occurring across various evaluation criteria over the course of a year,

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potentially influencing the formation of governmental policies, investment strategies, and transformative approaches for enterprises.

**Formulation of the problem.** The assessment of countries' digital development provides an opportunity to evaluate their developmental potential, as well as comprehensively assess the digital maturity of a country, which can significantly impact potential opportunities for transforming enterprise business processes. Therefore, studying priority directions of digitalization, strengths, prioritized sectors, as well as problematic areas, will enable enterprises to most successfully transform their business processes in response to rapid changes in economic conditions within the context of the country's digital development.

**Analysis of recent research and publications.** The issue of Ukraine's digital development level has attracted the attention of many Ukrainian researchers. Shtal T. [17; 18] pays attention to the trends in the development of the digital economy V. Voytenko [19] in his article examines Ukraine's position in rankings such as the ICT Development Index, E-government development index, Global Cybersecurity Index, and Digital Competitiveness Ranking. I. Dernova and T. Borovyk [2] focus on the trends and directions of Ukraine's digital economy development in the context of the pandemic based on the IMD World Digital Competitiveness ranking and the Network Readiness Index, considering sub-indices. M. Roshchuk [14] analyzes Ukraine's position in the E-Government Development Index, WEF/WITSA Networked Readiness Index, and IMD World Digital Competitiveness Ranking. Halushchak O., Halushchak M., and Mashliy H. [5] pay attention to the evolutionary transformations of the digitization process in Ukraine based on the IMD World Digital Competitiveness Ranking. Bezruk D. [1] highlights the following ranking indices of economic digitization: Global Innovation Index, Digital Economy and Society Index, ICT Development Index, Networked Readiness Index, Digital Evolution Index, Boston Consulting Group e-Intensity, Digital Adoption Index, and IMD World Digital Competitiveness Index. Podolchak N., Bilyk O., Levytska Ya. [12] focus on the Networked Readiness Index, Global Innovation Index, ICT Development Index, and Global Competitiveness Index. Polous O. [13] uses the IMD World Digital Competitiveness Ranking, WEF/WITSA Networked Readiness Index, The UNCTAD B2C E-commerce Index, and The Digital Economy and Society Index for analysis. Semenog A. [16] analyzes IMD World Digital Competitiveness Ranking, Digital Adoption Index, Global Connectivity Index, and Ease of Doing Digital Business. Rudenko M. [15] identifies the following indices of the digital economy: Digital Economy and Society Index, Digital Evolution Index, Digital Adoption Index, ICT Development Index,

Global Innovation Index, Networked Readiness Index, Boston Consulting Group – e-Intensity, and IMD World Digital Competitiveness Index.

Although a significant number of scholars' works have addressed Ukraine's position in international rankings of economic digitization, in most cases, they focus solely on the ranking position compared to other countries, without considering sub-indices and their developmental trends. However, identifying sub-index trends can enable the analysis and identification of Ukraine's strengths and weaknesses in the digitization process, providing information about the potential for transforming enterprise business processes in Ukraine.

**The aim of the article and the tasks to be fulfilled.** The purpose of the article is to analyze the development of various elements of Ukraine's digital economy to identify key trends, strengths, and weaknesses for determining the prospects of transforming business processes within Ukrainian enterprises.

The set objective has necessitated the need to address the following tasks:

- analyze international rankings characterizing the level of country's digitization;
- analyze Ukraine's position in the digital competitiveness ranking;
- examine sub-indices and subfactors in detail;
- identify strengths and weaknesses of Ukraine's digitization level.

**The subject:** Ukraine's position in international rankings that assess elements of the digital economy.

**The object:** development of Ukraine's digital economy.

**Research methods:** comparison, statistical analysis, decomposition.

**Presenting main material.** Currently, there is no single index that comprehensively evaluates a country's digital development. Therefore, to analyze various elements of the digital economy (such as infrastructure, government policies, human capital, competitiveness, ICT development, etc.), multiple indices are typically employed. In recent research analysis, it was found that the IMD World Digital Competitiveness Ranking is most commonly used to assess a country's level of digitization, which will be further elaborated upon.

The Digital Competitiveness Index is calculated by the Swiss International Institute for Management Development. Evaluation is conducted across three main categories, each with three sub-categories: knowledge (talent, education and learning, scientific concentration), technology (regulatory framework, capital, technological infrastructure), and future readiness (adaptive attitudes, business agility, IT integration).

Figure 1 presents information on the dynamics of rankings for select countries from 2017 to 2021

(as the index for Ukraine was not evaluated in 2022) based on the IMD World Digital Competitiveness Ranking.

From Figure 1, it can be deduced that during the analyzed period, the majority of countries did not significantly alter their positions in the ranking. However, a decline over the five years can be observed in Finland, Poland (in 2021), Bulgaria (in 2021), and Croatia. Meanwhile, Ukraine managed to improve its position in 2021.

For a more detailed analysis, let's examine the components of the index by sub-indices (knowledge, technology, future readiness) for select countries in 2021 based on the IMD World Digital Competitiveness Ranking (Figure 2).

From Figure 2, it can be inferred that a significant portion of countries exhibit even development across the three sub-indices. However, there are countries where one sub-index significantly deviates from

the others. For instance, in the USA, the "Future Readiness" sub-index greatly surpasses the others, whereas in Croatia and Hungary, this sub-index is notably lower than the rest. Argentina also stands out with a considerably lower "Technology" sub-index. Furthermore, in Ukraine, the value of the "Knowledge" sub-index significantly exceeds the other two sub-indices, surpassing this metric in several countries that rank considerably higher in the overall digital competitiveness assessment.

Figure 3 illustrates the dynamics of rankings for the components of the sub-factors: Knowledge (Talent, Training & education, Scientific concentration), Technology (Regulatory framework, Capital, Technological framework), and Future readiness (Adaptive attitudes, Business agility, IT integration).

From Figure 3, it can be concluded that although Ukraine improved certain indicators over the five years (Training & education, Regulatory framework,

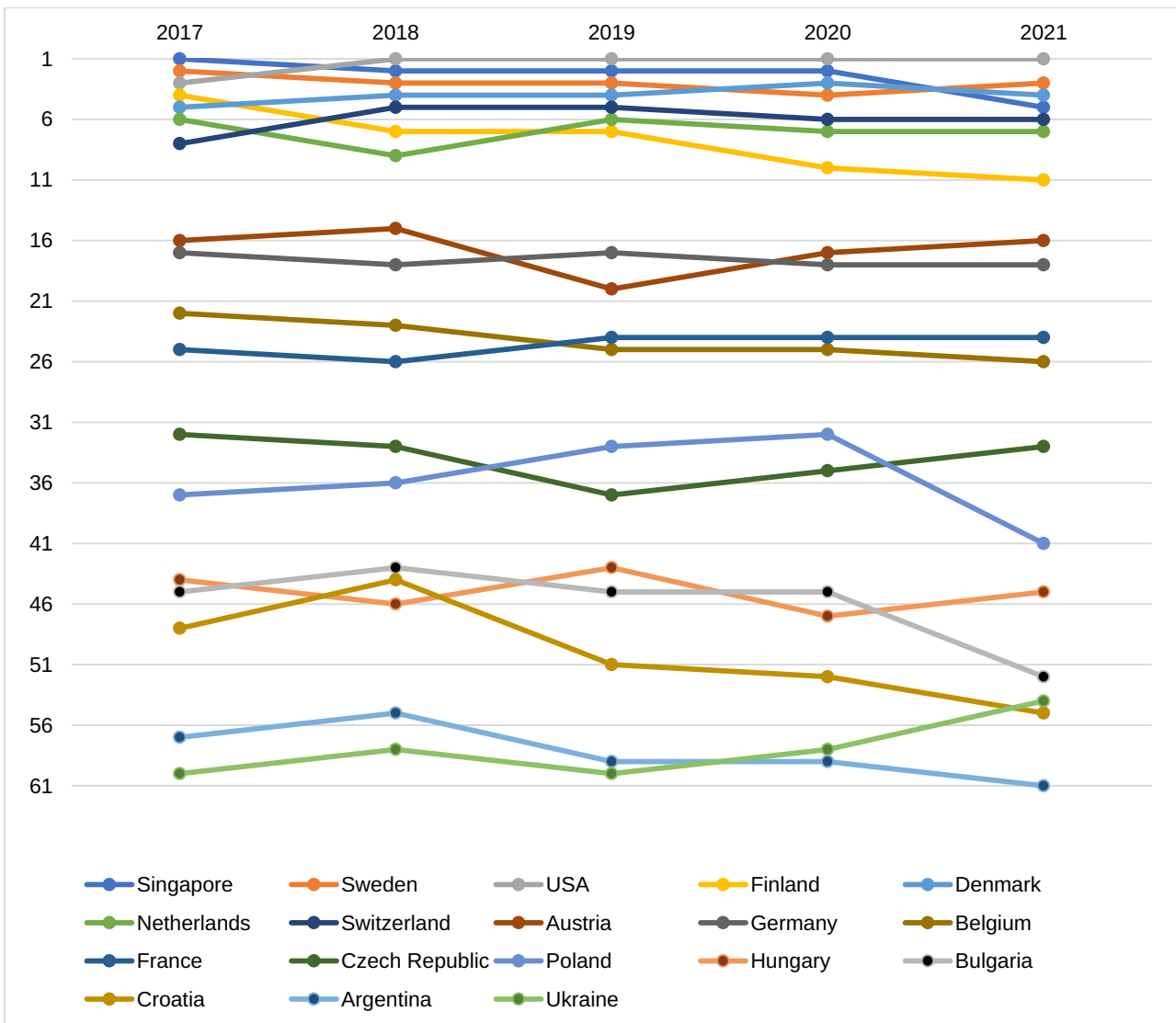


Figure 1. Dynamics of Rankings for Select Countries from 2017 to 2021 based on IMD World Digital Competitiveness Ranking

Source: Constructed by the author based on [6–10]

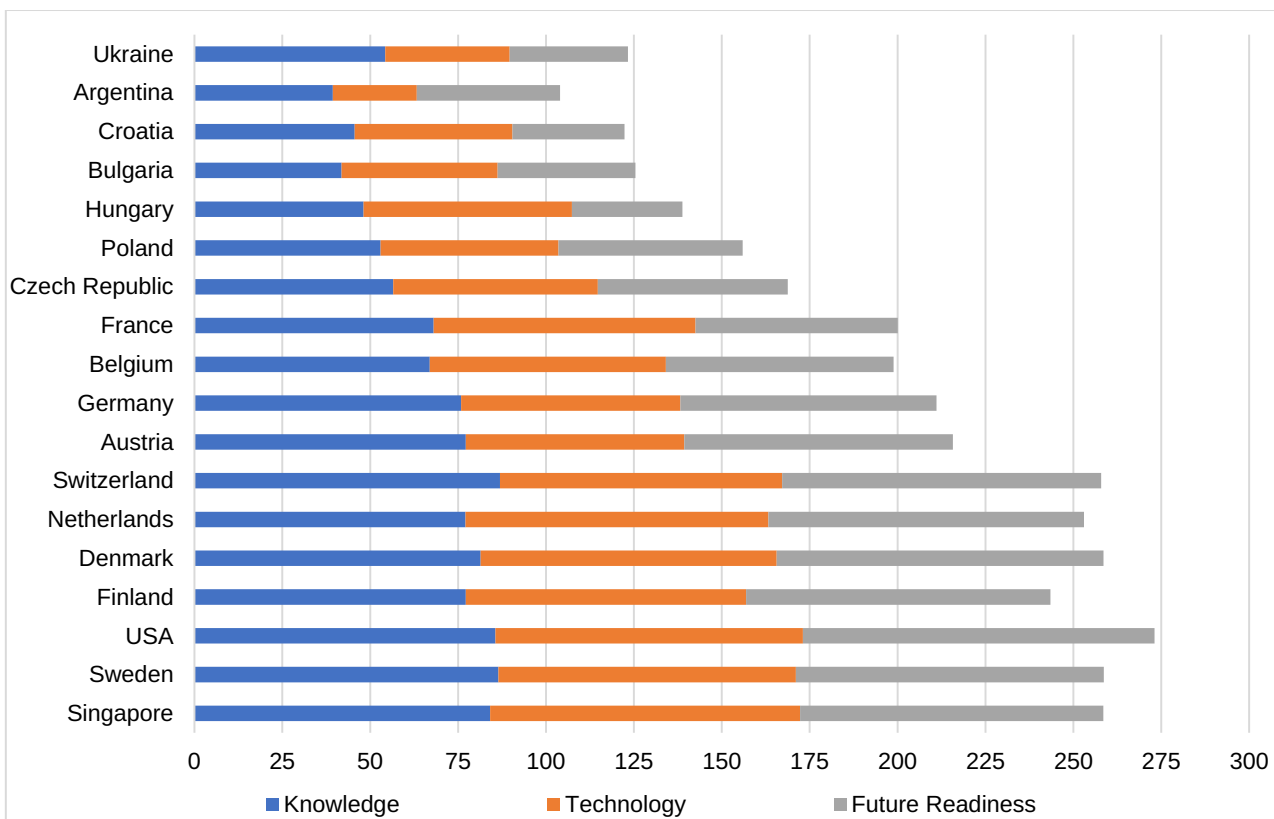


Figure 2. Sub-Indices (knowledge, technology, future readiness) for Select Countries in 2021 based on IMD World Digital Competitiveness Ranking.

Source: Constructed by the author based on [6–10]

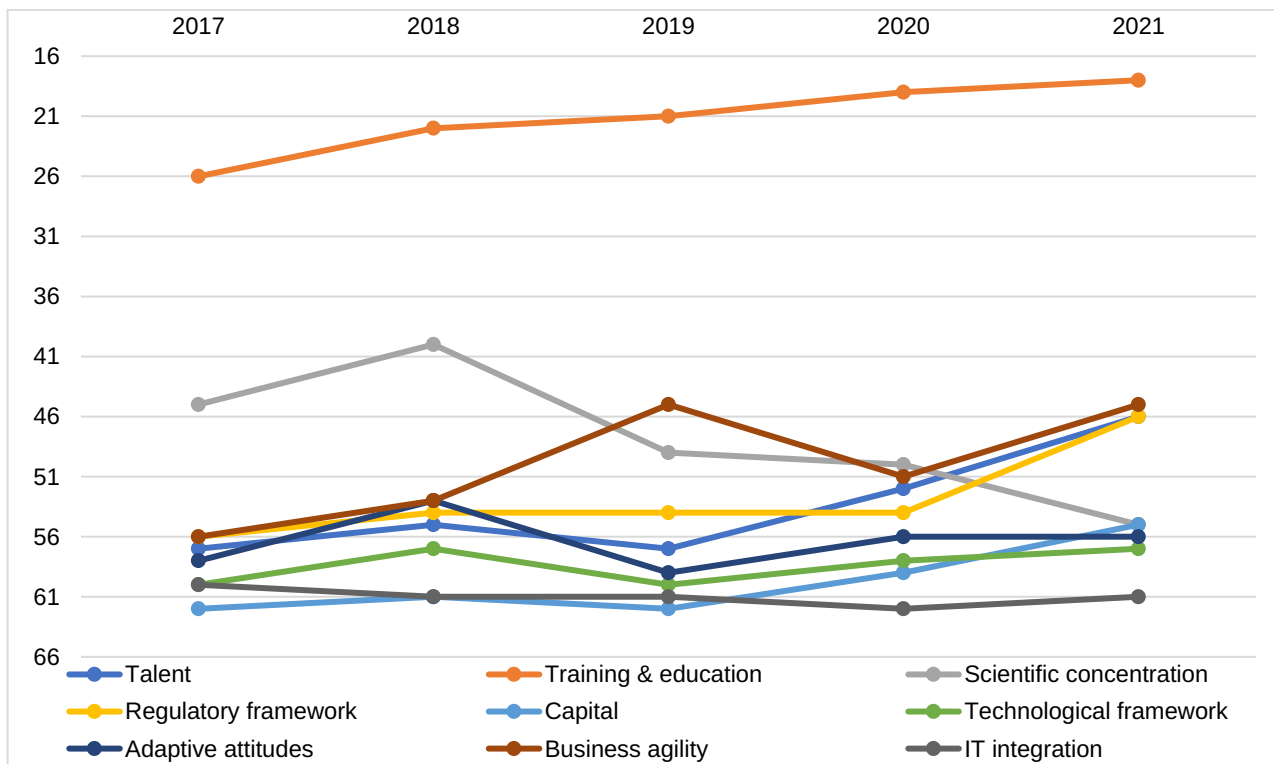


Figure 3. Dynamics of Rankings for Components of Sub-Factors Knowledge, Technology, and Future Readiness from 2017 to 2021 based on IMD World Digital Competitiveness Ranking.

Source: Constructed by the author based on [10]

Capital, Business agility), nearly all indicators (except Training & education) still remain at a relatively low level.

It is advisable to delve even deeper into the sub-factors to highlight the strengths and weaknesses of Ukraine's digital development. The data is presented in Table 1.

Thus, it can be concluded that the majority of indicators in Ukraine are at a relatively low level. Among the strengths, digital/technological skills, total public expenditure on education, pupil-teacher ratio (tertiary education), female researchers, R&D productivity by publication, investment in telecommunications, and use of big data and analytics stand out. On the other hand, the weaknesses include foreign highly-skilled personnel, intellectual property rights, funding for technological development, banking and financial services, country credit rating, venture capital,

mobile broadband subscribers, wireless broadband, knowledge transfer, public-private partnerships, and software piracy.

Another index highlighted by researchers in their studies is The Digital Economy and Society Index [4]. However, this index is calculated by the European Commission for EU countries and does not contain information regarding the digitalization of Ukraine's economy.

Researchers also mention the ICT Development Index, but according to information from the official website [11], it has not been assessed since 2018 due to issues with data access and quality.

Another index that could provide insight into the strengths and weaknesses of Ukraine's digital economy transformation is the "Ease of Doing Digital Business" index [3]. However, this index is also not evaluated for Ukraine.

Table 1

**The ranking position of Ukraine's sub-factors in 2021 according to the IMD World Digital Competitiveness Ranking**

<b>Talent</b>	<b>Rank</b>	<b>Training &amp; education</b>	<b>Rank</b>	<b>Scientific concentration</b>	<b>Rank</b>
Educational assessment PISA – Math	40	Employee training	37	Total expenditure on R&D (%)	53
International experience	49	Total public expenditure on education	11	Total R&D personnel per capita	45
Foreign highly-skilled personnel	58	Higher education achievement	–	Female researchers	17
Management of cities	50	Pupil-teacher ratio (tertiary education)	11	R&D productivity by publication	20
Digital/Technological skills	26	Graduates in Sciences	30	Scientific and technical employment	53
Net flow of international students	47	Women with degrees	–	High-tech patent grants	44
				Robots in Education and R&D	45
<b>Regulatory framework</b>	<b>Rank</b>	<b>Capital</b>	<b>Rank</b>	<b>Technological framework</b>	<b>Rank</b>
Starting a business	32	IT & media stock market capitalization	–	Communications technolog	38
Enforcing contracts	43	Funding for technological development	57	Mobile Broadband subscribers	64
Immigration laws	32	Banking and financial services	57	Wireless broadband	61
Development & application of tech.	55	Country credit rating	62	Internet users	46
Scientific research legislation	55	Venture capital	61	Internet bandwidth speed	48
Intellectual property rights	61	Investment in Telecommunications	2	High-tech exports (%)	54
<b>Adaptive attitudes</b>	<b>Rank</b>	<b>Business agility</b>	<b>Rank</b>	<b>IT integration</b>	<b>Rank</b>
E-Participation	39	Opportunities and threats	45	E-Government	53
Internet retailing	50	World robots distribution	51	Public-private partnerships	57
Tablet possession	55	Agility of companies	46	Cyber security	53
Smartphone possession	48	Use of big data and analytics	19	Software piracy	60
Attitudes toward globalization	47	Knowledge transfer	59		
		Entrepreneurial fear of failure	–		

Source: constructed by the author based on [10]

**Conclusions.** Thus, the article analyzed scholars' approaches to identifying international indices to assess the level of digital development of countries. It examined which of these indices evaluate indicators for Ukraine. The IMD World Digital Competitiveness Ranking was thoroughly examined, allowing not only the determination of Ukraine's position in the international ranking but also the analysis of sub-indices and sub-factors, enabling the identification of strengths and weaknesses in the process of digitization in Ukraine. The obtained results could be utilized in constructing a business process transformation strategy, identifying priority areas, opportunities, and obstacles for the integration of digital technologies into enterprise operations.

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