

Readiness for the Economy of the Future: Digitalization, AI, Innovation, Sustainability

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Abstract: The article examines the level of readiness of countries for the economy of the future based on an integral indicator formed from four international indices: Government AI Readiness Index (assessment of the role of artificial intelligence), Network Readiness Index (digitization and network effects), Global Innovation Index (innovation and human capital) and SDG Index (sustainable development). A methodology for constructing an integral indicator Future Economy Readiness Level (FERL) has been developed, which allows combining digital, innovative and socio-economic dimensions of development into a single generalized assessment. A comparative analysis of Ukraine and Germany in 2020–2024 was conducted, and FERL was also forecasted for 2025, which made it possible to identify the dynamics of key indicators and determine the strengths and weaknesses of both countries in the context of readiness for the economy of the future. The results of the study can be used to form strategies for digital transformation, innovation policy and ensuring sustainable development.

1 INTRODUCTION

Modern global transformations in digital technologies, innovations, and sustainable development require a rethinking of states' economic strategies. The concept of the economy of the future denotes a stage of development based on digitalization, AI integration, innovative production and management, and sustainability principles. However, countries' readiness for these changes varies and requires comprehensive assessment.

International indices are used to evaluate states' positions in this transition, including: Government AI Readiness Index (AI implementation readiness), Network Readiness Index (digitalization and network effects), Global Innovation Index (innovation

potential and human capital), and SDG Index (progress on Sustainable Development Goals). While each index reflects a specific aspect, their combined use provides a holistic view of a country's readiness.

The article aims to develop an integrated approach to assessing countries' readiness for the economy of the future using these indices and to compare Ukraine and Germany, identifying strengths, weaknesses, and practical recommendations for enhancing global competitiveness.

2 RELATED WORKS

A significant number of scholars are investigating various aspects of the transition to the economy of the

future. In [1], the Oxford Insights Government AI Readiness Index, its methodology, and challenges of use are analyzed. The author suggests ways to overcome the problems of data availability in developing countries. In [2], the study uses the DEA (Data Envelopment Analysis) method to assess the digital development of countries, based on the Network Readiness Index indicators. The authors propose an alternative approach to ranking countries and show that different methods can significantly change a country's place in the rankings. In [3], the results of the Network Readiness Index 2020 are analyzed in the context of COVID-19. The author emphasizes that the pandemic has accelerated digital transformation and highlighted inequalities between countries in readiness for the digital economy. In [4], the impact of human capital on the Global Innovation Index is analyzed, concluding that countries with a high level of education and qualification of the population show better innovation results. In [5], the role of innovation and human capital in shaping the knowledge economy is analyzed. It is shown that innovation directly depends on the level of development of human potential and the education system. The article [6] examines the intellectual potential of Ukrainian regions (educational, scientific, and innovative) in wartime conditions, conducts fractal analysis and forecasts key indicators. Negative trends are identified and the need to strengthen human capital and innovative capabilities for economic recovery is emphasized. In [7], a study was conducted on the relationship between digitalization, corporate governance, and reporting on the Sustainable Development Goals (SDGs). The author argues that digitalization can increase the transparency and effectiveness of sustainable development. In [8], the Digital Economy and Society Index (DESI) is studied to determine the impact of the Digital Economy and Society Index (DESI) on sustainable development indicators in the EU. The results show that countries with a higher level of digital economy have better results in the field of environmental and social sustainability. In [9], the digital transformation is studied to determine the impact of social sustainability in EU countries. The authors argue that digitalization has a positive but uneven impact on achieving the SDGs. The paper [10] examines the role of AI and aerospace engineering in achieving the Sustainable Development Goals. The article criticizes existing approaches and proposes interdisciplinary solutions. This study assumes a comprehensive consideration of the considered directions to ensure the transition to the economy of the future.

3 METHODOLOGY

The economy of the future is an integrated model of socio-economic development that combines digital transformation, the implementation of artificial intelligence technologies, a high level of innovation, the development of human capital and adherence to the principles of sustainable development. It is based on interconnected subsystems - digital, technological, innovative and socio-ecological - that shape the state's ability to adapt to global challenges, ensure economic sustainability, competitiveness and long-term growth.

Within this concept, the economy of the future is viewed not as a universal model, but as a complex, multi-level state of maturity of a country, reflecting its readiness to effectively use digital tools, data, artificial intelligence, innovative solutions, as well as to implement a policy of sustainable development and inclusive growth.

The proposed four subsystems are logical and methodologically sound, as they cover all key dimensions of modern socio-economic development. The digital subsystem reflects the level of digitalization of processes, access to digital infrastructure, use of data and digital services. This is the basic level of transformation, without which innovation and automation are impossible. The technological subsystem (including AI) covers the development of technologies, automation, artificial intelligence, R&D. It ensures increased productivity and competitiveness, acting as the core of technological change. The innovative and educational subsystem (human capital) takes into account the quality of education, skills, the ability to innovate, and the development of human potential. It is critical for adapting to technological change, training personnel and building the capacity for innovation. The socio-ecological subsystem (sustainable development) covers the environmental, social and institutional aspects of sustainable development. Ensures balance of transformations and takes into account social risks, inclusion and environmental responsibility. Thus, the choice of these four subsystems ensures completeness, systematicity and balance of the assessment, since each of them covers a separate dimension of development, and together they form a holistic model.

For a comprehensive assessment of a country's readiness for the economy of the future, an integrated indicator has been proposed - the Future Economy Readiness Level (FERL). It is based on the following components and their corresponding internationally recognized indices (Fig. 1, Table 1).

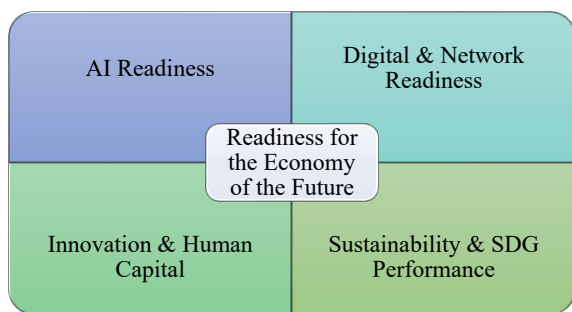


Figure 1: Structural elements of a country's readiness for the economy of the future.

Table 1: Structural elements of the economy of the future.

Structural component	Characteristic	Selected indicator
AI Readiness	determines the role of AI in economic development and the state's ability to introduce innovative technologies	Government AI Readiness Index (GARI)
Digital & Network Readiness	takes into account digitalization, infrastructure availability and network effects	Network Readiness Index (NRI)
Innovation & Human Capital	reflects the innovative potential and quality of human capital	Global Innovation Index (GII)
Sustainability & SDG Performance	demonstrates sustainable economic, social and environmental development	SDG Index

FERL calculation stages:

Stage 1. Data collection - obtaining official values of the specified indices for selected countries (Ukraine and Germany) in the period 2020-2024.

Stage 2. Normalization of indicators. Since all indices have a scale from 0 to 100, their values were used without additional transformations. If necessary, they are brought to a single scale.

Stage 3. Determination of weight coefficients. For a system with a descending order of priorities among N alternatives, weighting factors were determined using the Fishburne method:

$$p_i = (2(N-i+1)) / ((N+1)N), i = 1..N. \quad (1)$$

Stage 4. Calculation of the integral indicator:

$$FERL = w_{GARI} \cdot GARI + w_{NRI} \cdot NRI + w_{GII} \cdot GII + w_{SDG} \cdot SDG. \quad (2)$$

Stage 5. Comparison of results - FERL integral values are analyzed in dynamics and compared between countries.

Interpretation of results:

- Low level (0-20 points);
- Below average level (21-40 points);
- Average level – (41-60 points);
- Above average level – (61-80) points;
- High level – (81-100 points).

Thus, the integral FERL indicator allows combining various aspects of digitalization, innovation and sustainable development into a single generalizing assessment, which provides the possibility of interstate comparisons and the formation of strategic conclusions.

4 RESULT AND DISCUSSION

The study involves a comparative analysis of Ukraine and Germany as examples of countries with different levels of economic and technological development. This approach allows us to assess the universality of the integral indicator and demonstrate its applicability both for countries undergoing transformation and integration into world markets, and for highly developed economies that are already shaping global trends in digitalization, innovation, and sustainable development. This provides an opportunity to identify differences in development strategies, strengths and weaknesses of each country, and also forms the basis for developing practical recommendations.

4.1 AI Readiness

The development of AI is one of the key factors of the economy of the future. The Government AI Readiness Index (GARI) measures the level of readiness of government institutions, regulatory environment and digital infrastructure to implement AI technologies, which directly affects the competitiveness of the country. Table 2 and Figure 2 show a comparison of the values of this index for Ukraine and Germany over time.

Based on GARI data, the following conclusions can be drawn. Germany is consistently among the leaders in terms of AI readiness, ranking in the top 15, with a GARI in the range of 72,64-78,97. Ukraine is showing a gradual increase in readiness: its ranking improved from 57th place in 2020 to 54th in 2024, and the GARI index increased from 48,90 to 60,57. Despite the positive dynamics, Ukraine's readiness

level is still significantly lower than Germany, which indicates the need for further development of digital and innovation competencies for accelerated AI implementation.

Table 2: GARI for Ukraine and Germany [11].

Year	Indicator	Germany	Ukraine
2020	Rank	4/172	57/172
	GARI	78,97	48,90
2021	Rank	8/160	64/160
	GARI	77,26	50,58
2022	Rank	15/181	60/181
	GARI	72,64	52,80
2023	Rank	8/193	60/193
	GARI	75,26	53,29
2024	Rank	8/188	54/188
	GARI	76,90	60,57

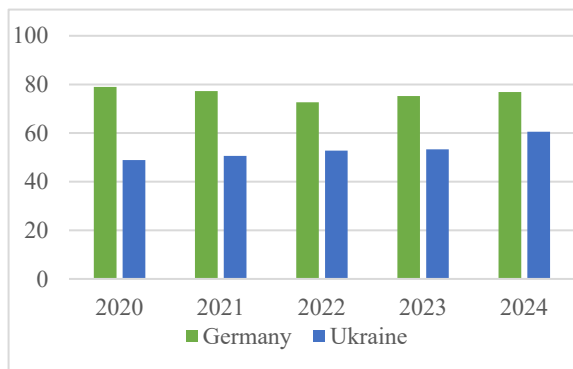


Figure 2: Comparison of GARI values for Ukraine and Germany in dynamics.

Table 3 shows the values of the index components for the countries studied, and Figure 3 details their values in 2024.

Table 3: The values of the index components for Ukraine and Germany [11].

Year	Country	Government	Technology Sector	Data and Infrastructure
2020	Germany	78,22	68,09	90,61
	Ukraine	-	-	-
2021	Germany	78,04	67,68	86,07
	Ukraine	52,36	38,19	61,19
2022	Germany	75,22	60,42	82,29
	Ukraine	68,96	34,68	54,74
2023	Germany	80,78	63,28	81,72
	Ukraine	68,93	36,18	54,75
2024	Germany	79,24	64,91	86,55
	Ukraine	73,42	41,93	66,37

Thus, Germany shows consistently high scores in all three components (government, technology sector, data and infrastructure), indicating comprehensive readiness for AI implementation. Ukraine shows gradual improvement, especially in the area of governance (from 52,36 in 2021 to 73,42 in 2024), while the technology sector and infrastructure remain relatively weak, limiting overall readiness.

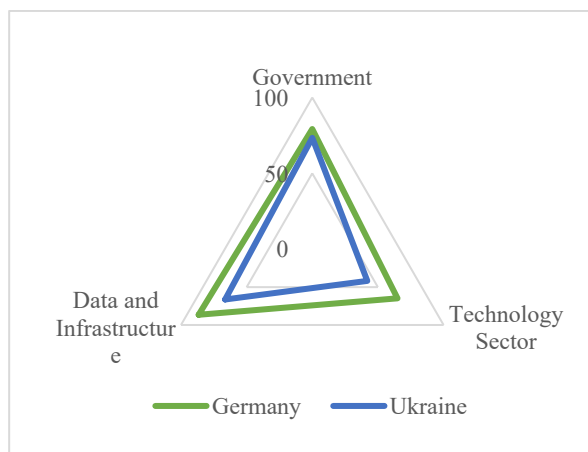


Figure 3: Comparison of the level of GARI components for Ukraine and Germany in 2024.

4.2 Digital and Network Readiness

The Network Readiness Index (NRI) reflects the level of digitalization of the economy, the development of information and communication technologies, the efficiency of digital networks, and the readiness of society to use digital innovations. This indicator determines the ability of a country to integrate into the global digital space. Table 4 and Figure 4 show a comparison of the values of this index for Ukraine and Germany over time.

Table 4: NRI for Ukraine and Germany [12].

Year	Indicator	Germany	Ukraine
2020	Rank	9 / 134	64 / 134
	NRI	77,48	49,43
2021	Rank	8 / 130	53 / 130
	NRI	78,95	55,70
2022	Rank	8 / 131	50 / 131
	NRI	76,11	55,71
2023	Rank	9 / 134	43 / 134
	NRI	74,00	55,16
2024	Rank	9 / 133	43 / 133
	NRI	73,54	55,32

Based on NRI data, the following conclusions can be drawn. Germany consistently maintains high

positions in the ranking (8-9th place) with an NRI of over 73, which indicates a strong digital infrastructure and readiness for network transformations. Ukraine demonstrates a gradual stabilization of NRI indicators at the level of 55-56, while improving its position in the ranking from 64th place in 2020 to 43rd in 2024. Overall, Ukraine is progressing, but remains significantly behind Germany in the area of digital readiness and network capabilities.

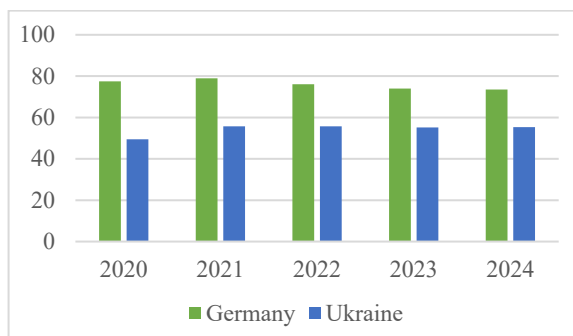


Figure 4: Comparison of NRI values for Ukraine and Germany in dynamics.

Table 5 and Figure 5 show the values of the index components for the studied countries in 2024.

Table 5: Comparison of the level of NRI components for Ukraine and Germany in 2024 [12].

Country	Показн	Technology	People	Governance	Impact
Ukraine	Rank	44	28	56	51
	Score	48,96	51,83	63,14	57,34
Germany	Rank	4	8	16	9
	Score	72,54	63,77	82,52	75,35

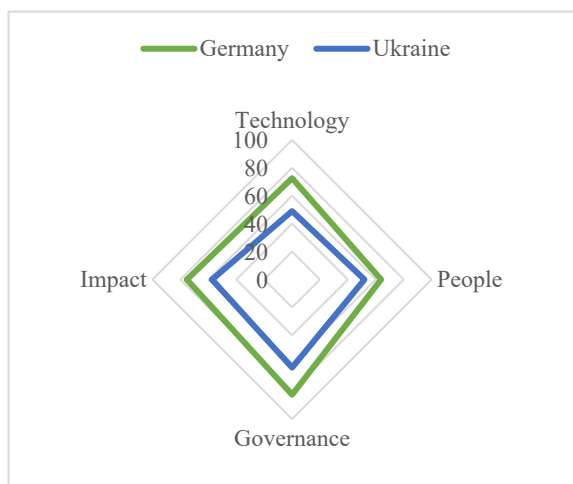


Figure 5: Comparison of the level of NRI components for Ukraine and Germany in 2024.

In 2024, according to the NRI, Germany ranks 9th with a score of 73,54, demonstrating a consistently high level of digital readiness and developed network infrastructure. Ukraine ranks 43rd with an NRI of 55,32, indicating a moderate level of digital readiness and the need for further development of infrastructure and technologies.

4.3 Innovation and Human Capital

The Global Innovation Index (GII) assesses technological capability, human capital development, research activity, innovation infrastructure and innovation performance. It is the combination of innovation and human capital that creates the foundation for sustainable economic growth in the long term. Table 6 and Figure 6 show a comparison of the values of this index for Ukraine and Germany over time.

Table 6: GII for Ukraine and Germany [13].

Year	Indicator	Germany	Ukraine
2020	Rank	9	45
	GII	56,55	36,32
2021	Rank	10	49
	GII	57,3	35,6
2022	Rank	8	57
	GII	57,2	31,0
2023	Rank	8	55
	GII	58,8	32,8
2024	Rank	9	60
	GII	58,1	29,5

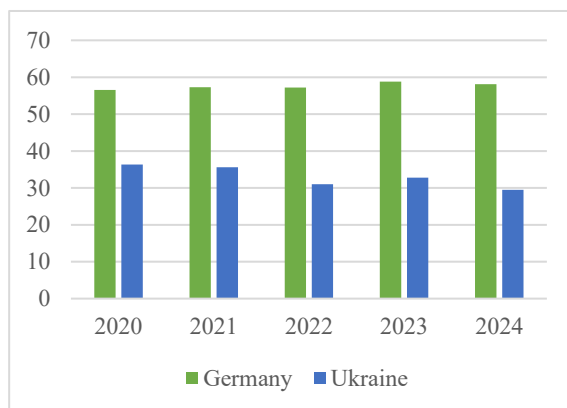


Figure 6: Comparison of GII values for Ukraine and Germany in dynamics.

According to the GII 2020-2024, Germany consistently maintains high positions (8-10th place) with GII scores of 56–59, indicating strong innovation potential. Ukraine shows a deterioration in its ranking from 45th place in 2020 to 60th in 2024

and a decrease in GII from 36,32 to 29,5, indicating a weak development of the innovation environment and the need for active reforms.

Table 7 and Figure 7 show the values of the index components for the studied countries in 2024.

Table 7: Comparison of the level of GII components for Ukraine and Germany in 2024 [13].

Structural elements	Germany	Ukraine
GII	58,1	29,5
Institutions	73,5	30,8
Human capital and research	61,4	34,3
Infrastructure	52,9	35,5
Market sophistication	56,4	25,7
Business sophistication	55,3	31,8
Knowledge and technology outputs	53,9	31,1
Creative outputs	58,6	23,7

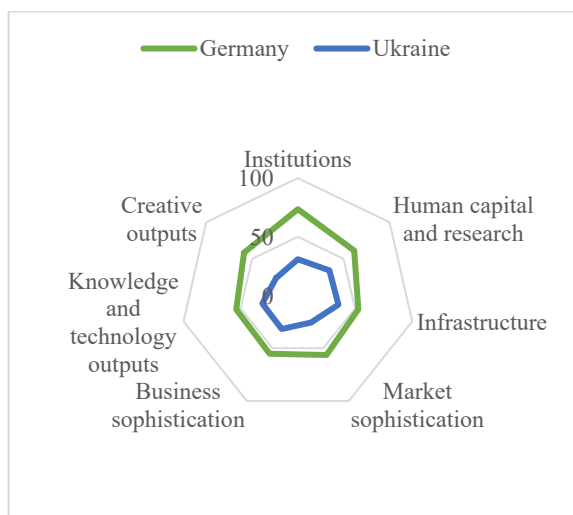


Figure 7: Comparison of the level of GII components for Ukraine and Germany in 2024.

Germany scores highly in all GII structural elements, especially in the areas of institutions (73,5), human capital and research (61,4) and creative output (58,6), indicating a strong innovation potential and a developed innovation environment. Ukraine scores significantly lower in all components, especially in market complexity (25,7) and creative output (23,7), indicating a weak development of innovation potential and the need to improve institutions, infrastructure and human capital.

4.4 Sustainability and SDG Performance

The SDG Index (SDGI) reflects a country's progress in achieving the UN Sustainable Development Goals. This index characterizes the environmental, social and economic balance that serves as the foundation for long-term sustainability and shaping the economy of the future. Table 8 and Figure 8 show a comparison of the values of this index for Ukraine and Germany over time.

Table 8: SDG Index for Ukraine and Germany [14].

Year	Indicator	Germany	Ukraine
2020	Rank	5/166	47/166
	SDGI	80,8	74,2
2021	Rank	4/165	36/165
	SDGI	82,5	75,5
2022	Rank	6/163	37/163
	SDGI	82,2	75,7
2023	Rank	4/166	38/166
	SDGI	83,4	76,5
2024	Rank	4/167	44/167
	SDGI	83,4	74,8
2025	Rank	4/167	42/167
	SDGI	83,7	75,7

Germany consistently maintains high positions (4-6th place) with SDGI indicators above 80, demonstrating effective achievement of the Sustainable Development Goals. Ukraine fluctuates between 36 and 47th place, with SDGI 74-76, indicating gradual progress, but still significantly lagging behind the leaders in the field of sustainable development.

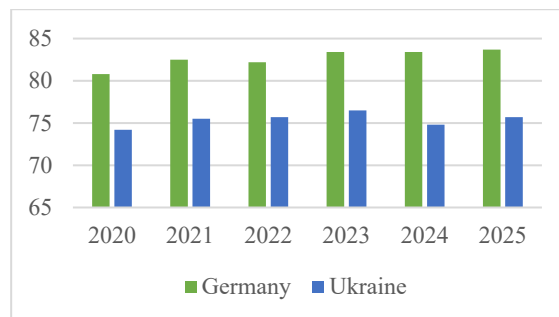


Figure 8: Comparison of SDG Index values for Ukraine and Germany in dynamics.

Figures 9 and 10 show the average performance by SDG for Germany and Ukraine, respectively.

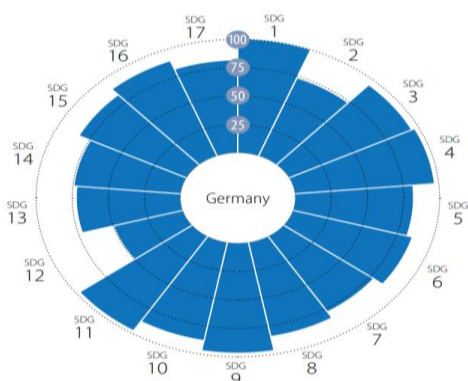


Figure 9: Average performance by SDG for Germany [14].

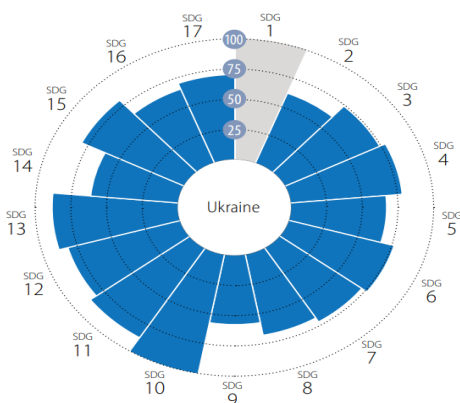


Figure 10: Average performance by SDG for Ukraine [14].

In 2024, in terms of average effectiveness of implementing the Sustainable Development Goals, Germany demonstrates high performance in all areas, while Ukraine lags significantly behind, especially in Goals 2, 9, 14, 16, 17.

4.5 Calculation and forecasting FERL

According to the Fishburne method, AI Readiness received the highest (rank 1), since the development of artificial intelligence, automation and high technologies determines the speed and direction of structural changes in the economy of the future, forming its core of transformations. Digital & Network Readiness took second place (rank 2), because it acts as a critical infrastructure foundation for the implementation of technologies, providing access to data, network interaction and platform models, although it does not directly drive transformations. Innovation & Human Capital

(rank 3) ensures the development of human capital and innovative activity, which allows adapting and scaling technological changes, but its impact manifests itself gradually and depends on technological and digital capabilities. Sustainability & SDG Performance (rank 4) forms long-term stability and balance of transformations through the principles of sustainable development, but its effect is indirect and is not the primary driver of the economy of the future.

Therefore, according to the proposed ranks and according to (1), the following weighting coefficients were obtained:

- $w_{GARI}=0,4;$
- $w_{NRI}=0,3;$
- $w_{GII}=0,2;$
- $w_{SDG}=0,1.$

Table 9 shows the values of the studied indices and the calculated indicator.FERL.

Table 9: Estimated value of the indicator FERL.

Year	Country	GARI	NRI	GII	SDGI	FERL
2020	Germany	78,97	77,48	56,55	80,8	74,22
	Ukraine	48,9	49,43	36,32	74,2	49,07
2021	Germany	77,26	78,95	57,3	82,5	74,30
	Ukraine	50,58	55,7	35,6	75,5	51,61
2022	Germany	72,64	76,11	57,2	82,2	71,55
	Ukraine	52,8	55,71	31	75,7	51,60
2023	Germany	75,26	74	58,8	83,4	72,40
	Ukraine	53,29	55,16	32,8	76,5	52,07
2024	Germany	76,9	73,54	58,1	83,4	72,78
	Ukraine	60,57	55,32	29,5	74,8	54,20
2025	Germany	84,03	72,17	58,4	83,7	75,31
	Ukraine	61,30	57,12	28,8	75,7	54,99

To predict values for 2025, the following models were used according to the high value of the coefficient of determination (Table 10).

Figure 11 shows a comparison of the FERL indicator for Ukraine and Germany.

According to the FERL 2020–2025, Germany demonstrates consistently high FERL values (71–75), indicating a strong and balanced readiness for the economy of the future in all components (AI,

digitalization, innovation, sustainable development). Ukraine shows a gradual increase in FERL from 49,07 in 2020 to 54,99 in 2025, but remains significantly behind Germany, especially due to low innovation indicators (GII).

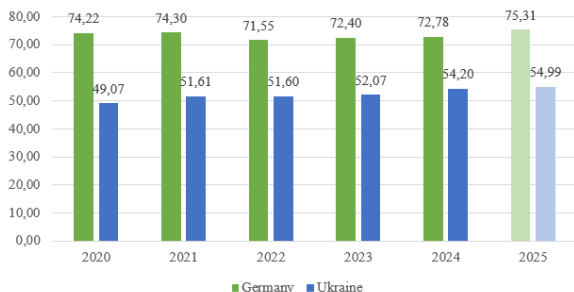


Figure 11: A comparison of the FERL indicator for Ukraine and Germany.

Table 10: Selected models for forecasting index values for 2025.

Index	Germany	Ukraine
GARI	$y = 0,1605x^3 - 0,4482x^2 - 2,8047x + 82,329$	$y = 45,962e^{0,048x}$
NRI	$y = -1,283x + 79,865$	$y = 3,4204\ln(x) + 50,989$
GII	$y = -0,0857x^2 + 0,9743x + 55,61$	$y = 0,0886x^2 - 2,1754x + 38,596$

Figure 12 shows a breakdown of the constituent elements (indices) and the FERL indicator in 2025.

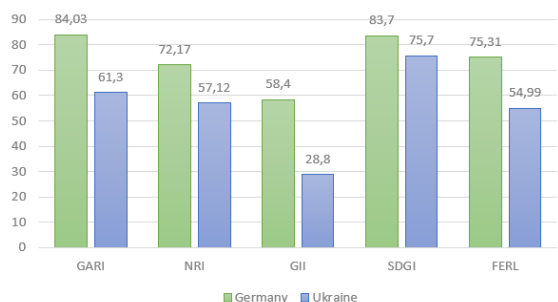


Figure 12: A breakdown of the constituent elements (indices) and the FERL indicator in 2025.

So, for Germany, the FERL level is above average, for Ukraine - at an average level. The lowest level in the structure of components for both countries is the GII. The highest value is in the SDGI Index. Overall, Ukraine is progressing, but needs active development of digital, innovation and institutional

components for an accelerated transition to the economy of the future.

5 CONCLUSIONS

The article proposes a methodology for assessing the readiness of countries for the economy of the future based on an integral indicator formed from four key indices. The Government AI Readiness Index reflects the role of artificial intelligence in the future economy, the Network Readiness Index characterizes the level of digitalization and the use of network effects, the Global Innovation Index determines the innovative potential and quality of human capital, and the SDG Index assesses the sustainability of development as a basis for long-term growth. It is predicted that in 2025, Ukraine's readiness level will be 54,99 points (average level), while for Germany – 75,31 points (above average). The lowest values for both countries are recorded for the Global Innovation Index, and the highest - for the SDG Index, which confirms the leading role of sustainable development in shaping the economy of the future. To increase the level of readiness, Ukraine should focus on developing an innovative environment, investing in human capital, building digital infrastructure, and more actively implementing solutions based on artificial intelligence.

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