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TRENDS OF THE AI ECONOMY IN RUSSIA

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A B S T R A C T

This paper is devoted to determining the trends of the AI economy in Russia. The method of trend analysis was used to find the dynamics of change in the values of the indicators of development of the AI economy in Russia. As a result, we revealed the specific features of its Russian model. The first feature is that in Russia, the key participant of the AI economy is the government, and the role of business, despite its being a secondary player, constantly grows. The second feature is that Russia successfully strengthens technological sovereignty in the sphere of the AI economy. The main conclusion is that in the Russian model, the advantages of the AI economy are connected with the growth of the share of knowledge-intensive employment and an increase in the quality of life, and its risks consist in a possible slowdown of the growth rate of labour productivity and reduction of the quality of products. The managerial significance of the paper is that the compiled econometric model generalised the leading experience of the top 30 AI economies in the world in 2023 and disclosed the cause-and-effect relationships of its development. The practical significance is that the authors' forecast outlined the perspective of the development of the AI economy in Russia in the Decade of Science and Technologies until 2031.

1. INTRODUCTION

Artificial intelligence is a technology that defines the technological mode of the economy in the 21st century. It is not just an increasing scale but a completely new character (foundation on smart technologies) of automatization that differentiates industrial revolutions of the 21st century (the Fourth Industrial Revolution which already started, the impending Fifth Industrial Revolution, and, possibly, the next ones) from the preceding industrial revolutions (the first three). Due to this, the creation and dissemination of AI technologies introduced serious changes in the innovative development of modern economic systems.

A closer scientific view of artificial intelligence from the position of C. Christensen's Theory of innovations (Christensen, 2007) shows that smart technologies are disruptive innovations. Not only does artificial intelligence create new markets and replace other technologies in the existing markets – but it also plays a key role during its joint use with other technologies (e.g., in machine vision, artificial intelligence is the leading technology – as well as in machine learning). That is, artificial intelligence fills the technological space of modern economic systems.

Due to this, modern economic systems, which are based on smart technologies, should be called AI economies, for this title reflects – very precisely and correctly – the technological nature of their economic growth and development. Like other types of economic systems, the AI economy has its specifics in different countries, due to which there has already formed a range of national

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models. One of the most vivid models is the Russian model of the AI economy, which deserves special attention and in-depth scientific research.

The problem is that the scientific vision of the Russian model of the AI economy has not yet been formed, despite its dynamic development and a vivid contrast with alternative national models. For example, unlike the Western European model, the Russian model of the AI economy prefers smart technologies that demonstrate the highest productiveness, and investments which will be most effective from the commercial point of view. At that, energy intensity is of secondary importance. It comes to the foreground in countries in Western Europe with a deficit of energy resources but is of no large significance in Russia, where energy security is at a high level.

Despite the large number of publications on the topic of AI, most of them have technical direction, while organisational & economic and managerial issues of the application of smart technologies have not been sufficiently developed. This paper strives towards dealing with the drawbacks of the existing literature and contributing to the solution of the problem posed by clarifying the specifics of the Russian model of the AI economy. It is necessary to study the trends of its development to determine the outlines of this model.

First, attention should be paid to the trends of recent years. Thus, determination of the origins, logic of formation, and regularities of the development of the AI economy in Russia will help identify its nature. Second, it is necessary also to take into account future trends, i.e., prospects for the development of the AI economy in Russia. Returning to the Theory of innovations, it should be noted that when studying the experience of Russia, like any other country, it is important to take into account the potential for further dissemination of AI. This is important for understanding whether this technology is promising or waning.

Based on the above, the goal of this paper was to determine the trends of the AI economy in Russia. This goal determines the structure of this research, in which the following is done: 1) determination of the modern trends of the AI economy in Russia; 2) identification of cause-and-effect relationships development of the AI economy; 3) compilation of the author's forecast of future trends, which discloses the perspective of the development of the AI economy in Russia.

2. LITERATURE REVIEW

The theoretical basis of this research is the published scientific works on the topic of the AI economy. In particular, certain organisational & economic and managerial issues of the application of AI technologies were disclosed in the works of such authors as Guerreiro Augusto et al. (2024) and Lanzalonga et al. (2024). The existing literature determines the expected advantages (implications) of the development of the AI economy, which are manifested to a different extent in different countries. These advantages include the following:

- Improvement of labour productivity due to automatization (Tokunova et al., 2023);
- Support for knowledge-intensive employment due to the increased technical complexity of labour with the use of AI and the necessity for manifesting innovative activity (Zhang, 2023);
- Technological complications of the manufactured and exported products (Lu et al., 2024);
- Improvement of product quality due to high-precision smart production and automatized quality control (Woźniak et al., 2022; Zimon et al., 2022);
- Raising the quality of life due to the growth of affordability of goods and services and intellectual support for their selection (Matytsin et al., 2023).

A potential drawback of the AI economy is the risk of an increase in the environmental costs of economic growth (Hong and Xiao, 2024). Also, the published works indicated the potential factors for the development of the AI economy, which include the following:

- Institutional support for the AI economy (Samothrakis, 2024);
- Personnel and technological support for dissemination of AI (Cramarenco et al., 2023);
- Telecommunication infrastructure in support of implementation and application of AI technologies (Schmitt, 2023).

The performed literature overview revealed that there is a large number of published works on the topic of the AI economy, which is a sign of a high level of elaboration of the problem posed and a strong fundamental basis for this research. Certain aspects of the application of AI technologies in the Russian economy were developed in the works of Ekimova (2023) and Samieva et al. (2023). However, the existing literature does not disclose the specifics of the Russian model of the AI economy, which remains unclear. This is a literature gap, which leads to the following research question (RQ): "What are the distinctive features of the AI economy in Russia?" To search for an answer to this RQ, this paper studies the trends of the AI economy in Russia.

3. MATERIALS AND METHODOLOGY

This paper sets and solves three tasks, which predetermined the research design. 1st task is to determine the modern trends of the AI economy in Russia. To solve it, the methods of horizontal and trend analysis were used. These methods were applied to find the dynamics of the change in the values of the indicators of the development of the AI economy in Russia.

In particular, the following is identified: 1) change in the activity of using AI technologies in state and corporate management in 2022 compared to 2020; 2) change in the activity of the development and use of AI technologies in 2022 compared to 2018; 3) change in the activity and share of publications of Russian scholars on the topic of AI in 2022 compared to 2010.

The empirical basis is the official statistics of the digital economy of the Institute for Statistical Research and Knowledge Economy of the Higher School of Economics (2024). When studying the trends of recent years, consideration is given to the fact that the regulatory basis for the formation of the AI economy in Russia was set in 2019 (Ministry of Economic Development of the Russian Federation, 2024). 2nd task: identifying cause-and-effect relationships of the AI economy development.

To solve it, the method of regression analysis is used. Econometric modelling of the influence of the share of organisations that use AI technologies (U_{AI}, as a result of 2022 – the data are relevant as of early 2023, according to the Institute for Statistical Research and Knowledge Economy of the Higher School of Economics) on the following expected consequences of the AI economy development is performed:

- "Labor productivity growth" (CSQ_1) according to WIPO (2024);
- "Knowledge-intensive employment" (CSQ_2) according to WIPO (2024);
- "Production and export complexity" (CSQ_3) according to WIPO (2024);
- "ISO 9001 quality/bn PPP$ GDP" (CSQ_4) according to WIPO (2024);
- "Ecological sustainability" (CSQ_5) according to WIPO (2024);
- "Quality of life index" (CSQ_6) according to Numbeo (2024).

Also, econometric modelling of the dependence of the share of organisations that use AI technologies (according to the Institute for Statistical Research and Knowledge Economy of the Higher School of Economics, 2024) on the following factors of state regulation according to WIPO (2024) is performed:

- "Institutions" (Reg_1);
- "Human capital and research" (Reg_2);
- "Information and communication technologies (ICTs)" (Reg_3).

The timeframe of the research is 2023. The sample includes the top 30 AI economies of the world by the criterion of the activity of the use of AI technologies in organisations based on the statistics of the Institute for Statistical Research and Knowledge Economy of the Higher School of Economics (2024). Statistical data for the research are systematised in Table 1.

Table 1. The use of AI in organisations, its potential factors and consequences in 2023

Country	Share of organisations that use AI technologies, %	Institutions, score 0-100	Human capital and research, score 0-100	ICTs, score 0-100	Labour productivity growth, %	Knowledge-intensive employment, %	Production and export complexity, score 0-100	ISO 9001 quality/bn PPP$ GDP	Ecological sustainability, score 0-100	Quality of life index, score 0-200
	U_{AI}	Reg_1	Reg_2	Reg_3	CSQ_1	CSQ_2	CSQ_3	CSQ_4	CSQ_5	CSQ_6
Austria	9	78.46	57.97	86.32	0.22	44.26	88.06	7.08	44.96	185.8
Belgium	10	68.27	55.36	70.86	0.16	49.17	76.27	4.32	33.81	157.3
Brazil	13	38.47	33.53	81.01	-0.05	23.87	53.24	4.79	23.94	105.2
Bulgaria	3	49.54	31.11	78.14	2.86	32.63	65.76	37.40	57.84	131.6
Canada	5	78.02	58.06	82.26	0.17	43.72	64.40	2.70	22.24	162.3
Croatia	9	47.97	36.57	81.06	1.75	35.24	69.30	21.44	58.96	163.2
Czech	5	63.68	44.58	73.29	0.93	40.05	89.83	24.37	55.50	163.6
Denmark	24	83.88	58.07	94.16	0.39	48.89	75.98	6.03	56.16	194.7
Estonia	3	78.60	42.89	95.61	1.95	46.83	73.19	17.87	57.24	171.9
Finland	16	85.44	59.96	94.68	-0.49	47.42	81.90	9.84	52.36	190.5
France	7	70.00	54.01	84.14	-0.25	47.74	79.51	6.59	39.33	153.8
Germany	1	71.94	61.10	82.03	-0.05	46.13	93.62	10.09	41.15	179.0
Greece	3	50.89	45.06	76.89	-0.56	31.96	57.70	20.62	47.88	128.6
Hungary	3	58.42	40.19	72.12	2.41	38.73	84.83	21.77	53.29	134.3
Ireland	8	77.45	45.23	78.29	-0.07	47.20	80.76	3.81	58.98	154.0
Italy	6	55.45	43.73	81.06	0.25	35.68	80.51	34.31	52.76	140.9
Latvia	4	62.80	37.42	82.98	2.27	44.74	67.36	13.11	46.79	153.2
Lithuania	5	73.49	37.43	79.51	1.98	46.59	70.44	10.80	50.00	161.5
Netherlands	13	82.26	55.73	92.11	-0.14	53.65	73.19	8.43	41.29	196.7
Norway	1	85.07	53.22	82.72	0.22	52.27	67.05	7.09	42.68	182.7
Poland	3	47.13	37.66	76.86	3.30	41.52	73.82	7.42	32.20	139.9

Portugal	17	64.26	49.55	80.86	0.76	41.92	68.40	11.14	38.96	163.8
Republic of Korea	3	66.68	66.89	95.69	1.21	39.59	93.36	7.04	29.68	133.0
Romania	1	47.58	29.06	73.98	3.32	28.24	79.22	18.26	58.92	132.9
Russia	8	34.88	47.17	74.84	1.26	45.48	56.71	0.98	13.43	103.0
Slovakia	5	49.87	33.95	71.67	1.09	38.31	82.49	21.24	55.79	149.7
Slovenia	12	63.30	47.62	84.86	1.63	46.66	84.79	21.06	52.83	169.3
Spain	8	59.19	45.64	84.04	-0.49	35.71	68.58	15.89	52.15	173.8
Sweden	10	74.33	62.68	86.68	0.99	57.14	85.90	5.12	51.43	175.8
Türkiye	3	36.48	37.49	80.52	2.63	23.95	65.67	3.17	21.10	119.4

Source: Compiled by the authors based on the materials of the Institute for Statistical Research and Knowledge Economy of the Higher School of Economics (2024), Numbeo (2024), and WIPO (2024).

The reliability of the results of the regression analysis is determined with the help of coefficients of determination and the F-test. As a result of the regression analysis, factors and consequences from Table 1 are classified in the following way:

- Not connected with the use of AI in organisations (in which regression equations the coefficients of determination have low values, and the F-test was not passed);
- Negatively connected with the use of AI in organisations (in which regression equations the coefficients of regression have positive values);
- Positively connected with the use of AI in organisations (in which regression equations the coefficients of regression have negative values).

We select indicators that are positively and negatively connected with the use of AI in organisations. They are included in the general econometric model, which reflects the cause-and-effect relationships of the AI economy development. 3rd task: to compile an authors' forecast of future trends, which shows the perspective of the development of the AI economy in Russia.

To solve it, we use the method of forecasting for the long-term, in the Decade of Science and Technologies in Russia (President of the Russian Federation, 2024), i.e., until 2031. To compile the forecast, we insert in the econometric model the values of indicators in Russia, and then the values Reg_1-Reg_3 are replaced by the maximum possible ones (100 points), and then we determine the change in other indicators that are connected with them. The method of trend analysis is used to find the change in the values of indicators in 2031 compared to 2023, according to the forecast.

4. RESULTS

4.1. Modern trends of the AI economy in Russia

To solve the first task of this research and reveal the modern trends of the AI economy in Russia, the methods of horizontal and trend analysis are used to determine the dynamics of change in the values of the indicators of the AI economy development in Russia. First, we determine the change in the activity of the use of AI technologies in state and corporate management in 2022 compared to 2020 (Figure 1).

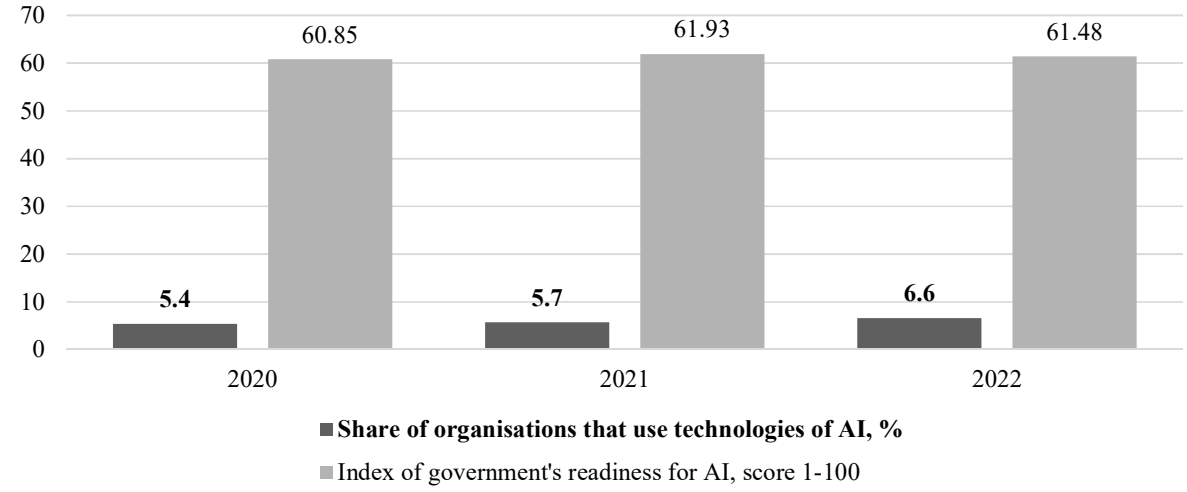

Figure 1. Dynamics of the activity of the use of AI technologies in state and corporate management in Russia in 2020-2022, %

Source: built by the authors based on the materials of the Institute for Statistical Research and Knowledge Economy of the Higher School of Economics (2024).

As shown in Figure 1, the trend of the change in the share of organisations that use AI technologies in Russia in 2022 (6.6% of organisations) compared to 2020 (5.4% of organisations) equals 22.22%. The trend of the change in the share of the government's readiness for AI in Russia in 2022 (61.48 points) compared to 2020 (60.85 points) is more moderate, equalling 1.04%. The horizontal analysis showed that in 2021 (61.93 points), the annual growth of this readiness was 1.77%, and in 2022, the annual change in this readiness was negative – it decreased by 0.73%.

It is notable that for both indicators, the maximum possible value is 100, due to which Figure 1 vividly demonstrates not only trends but also clear differences in the involvement of business and government in the AI economy in Russia. Second, we determined the change in the activity of the development and use of AI technologies in 2022 compared to 2018 (Figure 2).

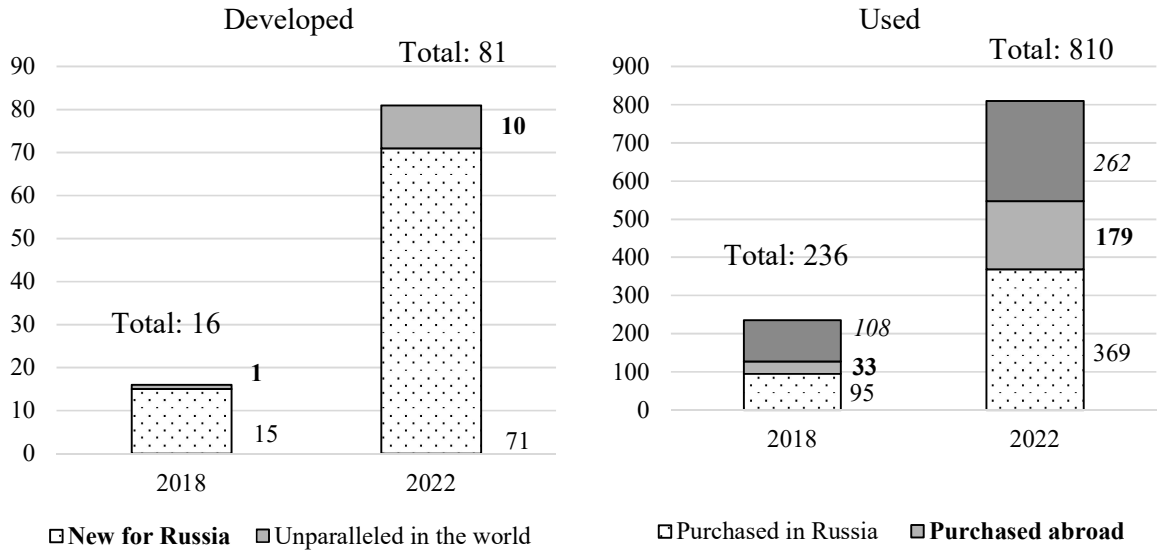

Figure 2. Dynamics of AI technologies that were developed and used in Russia in 2018-2022
Source: built by the authors based on the materials of the Institute for Statistical Research and Knowledge Economy of the Higher School of Economics (2024).

As shown in Figure 2, the trend of the number of developed AI technologies in Russia in 2022 (81), compared to 2018 (16), equals 406.25% (an increase of more than five times). The share of developed AI technologies in Russia, which are unparalleled in the world, grew by 111.27% (by more than two times), from 6.67% in 2018 to 14.08% in 2022. At that, most developed AI technologies are invariable new only for Russia (93.33% in 2018 and 85.92% in 2022).

The trend of the number of used AI technologies in Russia in 2022 (810), compared to 2018 (236), equals 243.22% (an increase of more than 3.5 times). The share of AI technologies purchased in Russia grew by 13.17%, from 40.25% in 2018 to 45.56% in 2022. It should be noted that the share of AI technologies that are purchased abroad is relatively small, equalling 13.98% in 2018 and 22.10% in 2022, but its trend is positive, equalling 58.04% (an increase of more than 1.5 times). Third, we determined the change in the activity and share of publications of Russian scholars on the topic of AI in 2022 compared to 2010 (Figure 3).

As shown in Figure 3, the trend of the number of publications of Russian authors on the topic of AI in Scopus-indexed publications in 2022 (1,970), compared to 2010 (94), equals 1,995.74% (growth of more than 21 times). The trend of the share of Russia in the world total number of Scopus-indexed publications on the topic of AI in 2022 (0.2%), compared to 2010 (1.4%), equals 600% (growth by more than 7 times).

The horizontal analysis showed that the largest annual progress was achieved in 2016 (growth of the number of publications by 200.91%, growth of the share by 116.67%), and 2021 marked a decrease (the number of publications decreased by 34.51%, and the share – by 46.43%). 2002 marked the continuation of the share (-6.67%). This is a positive long-term trend, but a sign of the negative current change in the publication activity of Russian scholars who study artificial intelligence, in Scopus-indexed publications.

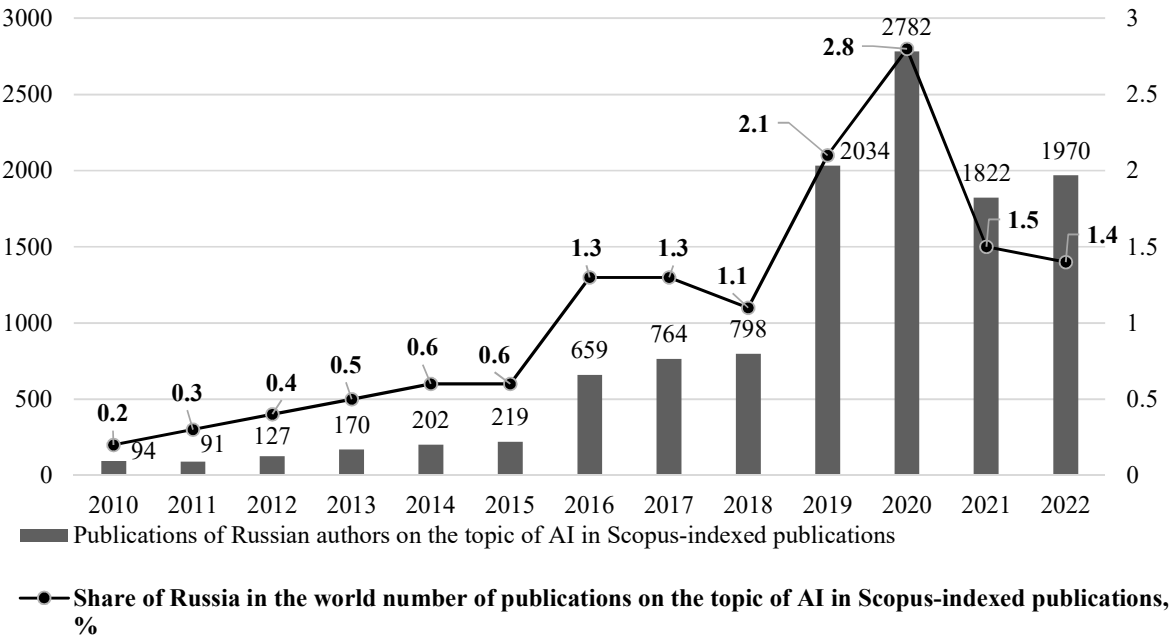

Figure 3. Dynamics of the publication activity of Russian authors in the Scopus database on the topic of AI in 2010-2022

Source: Built by the authors based on the materials of the Institute for Statistical Research and Knowledge Economy of the Higher School of Economics (2024).

4.2. Cause-and-effect relationships of the development of the AI economy

To solve the second task of this research and identify the cause-and-effect relationships development of the AI economy, we used the data from Table 1 and the method of regression analysis to perform econometric modelling of the connection of the share of organisations that use AI technologies (U_{AI}) and expected consequences (Table 2-7) and expected factors of the AI economy development (Table 8).

Table 2. Regression analysis of the dependence of CSQ_1 on U_{AI}

Regression statistics	
Multiple R	0.5255
R-squared	0.2761
Adjusted R-squared	0.2502
Standard error	1.0172
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	11.0503	11.0503	10.6795	0.0029
Residual	28	28.9720	1.0347		
Total	29	40,0222			

	Coefficients	*Standard error*	*t-Stat*	*P-Value*	*Lower 95%*	*Upper 95%*
Y-intercept	1.9351	0.3441	5.6232	0.0000	1.2302	2.6400
U_{AI}	-0.1193	0.0365	-3.2680	0.0029	-0.1941	-0.0445

Source: Authors.

According to the results from Table 2, among the top 30 AI economies in the world in 2023, the change in labour productivity was by 52.55% determined by the influence of the change in the activity of the use of AI technologies in organisations. Significance F equals 0.0029 – therefore, the level of significance is the highest, equalling 0.01.

At the set level of significance, at k_1=1 (the only factor variable: U_{AI}), k_2=30-1-1=28, F-table equals =7.6356. F-observed equals 10.6795 – it exceeds the F-table and, therefore, the F-test was passed. This confirms the reliability of the results of the regression analysis. Since the regression coefficient took the negative value, labour productivity is negatively connected with the use of AI in organisations.

Table 3. Regression analysis of the dependence of CSQ_2 on U_{AI}

Regression statistics	
Multiple R	0.4105
R-squared	0.1685
Adjusted R-squared	0.1388
Standard error	7.6302
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	330.4254	330.4254	5.6755	0.0242
Residual	28	1630.1447	58.2195		
Total	29	1960.5700			

	Coefficients	*Standard error*	*t-Stat*	*P-Value*	*Lower 95%*	*Upper 95%*
Y-intercept	36.6658	2.5814	14.2041	0.0000	31.3781	41.9534
U_{AI}	0.6526	0.2739	2.3823	0.0242	0.0915	1.2137

Source: Authors.

According to the results from Table 3, in the top 30 AI economies in the world in 2023, the change in knowledge-intensive employment was 41.05% determined by the influence of the change in the activity of the use of AI technologies in organisations. Significance F equals 0.0242 – therefore, the level of significance equals 0.05.

At the set level of significance, at k_1=1 (the only factor variable: U_{AI}), k_2=30-1-1=28, F-table equals 4.1960. F observed equals 5.6755 – it exceeds the F table. Therefore, the F test was passed. This confirms the reliability of the results of the regression analysis. Since the regression coefficient took a positive value, knowledge-intensive employment is positively connected with the use of AI in organisations.

Table 4. Regression analysis of the dependence of CSQ_3 on U_{AI}

Regression statistics	
Multiple R	0.0088
R-squared	$7.7*10^{-05}$
Adjusted R-squared	-0.0356
Standard error	10.7784
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.2520	0.2520	0.0022	0.9632
Residual	28	3252.8492	116.1732		
Total	29	3253.1011			

	Coefficients	*Standard error*	*t-Stat*	*P-Value*	*Lower 95%*	*Upper 95%*
Y-intercept	74.9184	3.6464	20.5458	$2*10^{-18}$	67.4490	82.3877
U_{AI}	0.0180	0.3870	0.0466	0.9632	-0.7746	0.8107

Source: Authors.

According to the results from Table 4, among the top 30 AI economies in the world in 2023, the change in technological complexity of the manufactured and exported products was by 0.88% determined by the influence of the change in the activity of the use of AI technologies in organisations. Significance F equals 0.9632 – therefore, the results of the regression analysis are statistically insignificant and unreliable. Therefore, the technological complexity of the manufactured and exported products is not connected with the use of AI in organisations.

Table 5. Regression analysis of the dependence of CSQ_4 on U_{AI}

Regression statistics	
Multiple R	0.3304
R-squared	0.1092
Adjusted R-squared	0.0773
Standard error	8.8948
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	271.4537	271.4537	3.4311	0.0746
Residual	28	2215.2665	79.1167		
Total	29	2486.7202			

	Coefficients	*Standard error*	*t-Stat*	*P-Value*	*Lower 95%*	*Upper 95%*
Y-intercept	17.4852	3.0092	5.8106	0.0000	11.3212	23.6492
U_{AI}	-0.5915	0.3193	-1.8523	0.0746	-1.2456	0.0626

Source: Authors.

According to the results from Table 5, among the top 30 AI economies in the world in 2023, the change in the quality of products was by 33.03% determined by the influence of the change in the activity of the use of AI technologies in organisations. Significance F equals 0.0746 – therefore, the level of significance equals 0.10. At the set level of significance, at k_1=1 (the only factor variable: U_{AI}), k_2=30-1-1=28, F-table equals 2.8938. F observed equals 3.4311 – it exceeds the F table. Therefore, the F-test was passed. This confirms the reliability of the results of the regression analysis. Since the regression coefficient took a negative value, the quality of products is negatively connected with the use of AI in organisations.

Table 6. Regression analysis of the dependence of CSQ_5 on U_{AI}

Regression statistics	
Multiple R	0.0155
R-squared	0.0002
Adjusted R-squared	-0.0355
Standard error	13.0612
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.1466	1.1466	0.0067	0.9352
Residual	28	4776.6624	170.5951		
Total	29	4777.8090			

	Coefficients	*Standard error*	*t-Stat*	*P-Value*	*Lower 95%*	*Upper 95%*
Y-intercept	44.4834	4.4187	10.0670	0.0000	35.4320	53.5347
U_{AI}	0.0384	0.4689	0.0820	0.9352	-0.9221	0.9990

Source: Authors.

According to the results from Table 6, among the top 30 AI economies of the world in 2023, the change in the environmental sustainability of the economy was by 1.55% determined by the influence of the change in the activity of the use of AI technologies in organisations. Significance F equals 0.9352 – therefore, the results of the regression analysis are statistically insignificant and unreliable. Therefore, the environmental sustainability of the economy (environmental costs of economic growth) is not connected with the use of AI in organisations.

Table 7. Regression analysis of the dependence of CSQ_6 on U_{AI}

Regression statistics	
Multiple R	0.5427
R-squared	0.2945
Adjusted R-squared	0.2693
Standard error	21.2992
Observations	30

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	5302.5980	5302.5980	11.6886	0.0019
Residual	28	12702.3566	453.6556		
Total	29	18004.9547			

	Coefficients	*Standard error*	*t-Stat*	*P-Value*	*Lower 95%*	*Upper 95%*
Y-intercept	134.9734	7.2057	18.7315	0.0000	120.2132	149.7336
U_{AI}	2.6143	0.7647	3.4189	0.0019	1.0479	4.1806

Source: Authors.

According to the results from Table 7, among the top 30 AI economies in the world in 2023, the change in the quality of life was by 54.27% determined by the influence of the change in the activity of the use of AI technologies in organisations. Significance F equals 0.0019 – therefore, the level of significance is the highest, equalling 0.01.

At the set level of significance, at k_1=1 (the only factor variable: U_{AI}), k_2=30-1-1=28, F-table equals =7.6356. F-observed equals 11.6886 – it exceeds the F-table and, therefore, the F-test was passed. This confirms the reliability of the results of the regression analysis. Since the regression coefficient took a positive value, the quality of life is positively connected with the use of AI in organisations.

Table 8. Regression analysis of the dependence of U_{AI} on Reg_1-Reg_3

Regression statistics	
Multiple R	0.5162
R-squared	0.2664
Adjusted R-squared	0.1818
Standard error	4.6787
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	206.7206	68.9069	3.1478	0.0420
Residual	26	569.1461	21.8902		
Total	29	775.8667			

	Coefficients	*Standard error*	*t-Stat*	*P-Value*	*Lower 95%*	*Upper 95%*
Y-intercept	-12.3546	10.4549	-1.1817	0.2480	-33.8449	9.1357
Reg_1	0.0469	0.0839	0.5592	0.5808	-0.1255	0.2193
Reg_2	0.1405	0.1201	1.1696	0.2528	-0.1064	0.3873
Reg_3	0.1307	0.1567	0.8341	0.4118	-0.1914	0.4528

Source: Authors.

According to the results from Table 8, among the top 30 economies in the world in 2023, the change in the activity of the use of AI technologies in organisations was 51.62% determined by the influence of the change of the aggregate influence of state regulation factors. Significance F equals 0.0420 – therefore, the level of significance is the highest, equalling 0.05.

At the set level of significance, at k_1=3 (three factor variables: Reg_1, Reg_2, Reg_3), k_2=30-3-1=26, F-table equals 2.9752. F-observed equals 3.1478 – it exceeds F-table. Therefore, the F-test was passed. This confirms the reliability of the results of the regression analysis. Since the coefficients of regression took positive values, all three considered factors of state regulation are positively connected with the use of AI in organisations.

As a result of the performed regression analysis, we selected all statistically significant – positively and negatively connected with the use of AI in organisations – variables, which are included in the following general econometric model:

$$\begin{cases} CSQ_1=1.9351-0.1193*U_{AI}, \\ CSQ_2=36.6658+0.6526*U_{AI},s \\ CSQ_4=17.4852-0.5915*U_{AI}, \\ CSQ_6=134.9734+2.6143*U_{AI}, \\ U_{AI}=-12.3546+0.0469*Reg_1+0.1405*Reg_2+0.1307*Reg_3. \end{cases} \quad (1)$$

The model (1) showed the cause-and-effect relationships of the development of the AI economy. Thus, an increase in the share of organisations that use AI technologies leads to an increase in the share of knowledge-intensive employment by 0.6526% and an increase in the quality of life by 2.6143 points, but to a decrease in the growth rate of labour productivity by 0.1193% and a decrease in the quality of products by 0.5915 bn PPP$ GDP.

Improvement of the institutional support of the AI economy by 1 point leads to the growth of the share of organisations that use AI technologies by 0.0469%. Improvement of personnel and technological support for the dissemination of AI by 1 point leads to an increase in the share of organisations that use AI technologies by 0.1405%. An increase in the level of the development of telecommunication infrastructure by 1 point ensures the growth of the share of organisations that use AI technologies by 0.1307%.

4.3. Future trends and the perspective of AI economy development in Russia

To solve the third task of this research and compile the authors' forecast of future trends that discloses the perspective of AI economy development in Russia, we insert into the model (1) the values of the indicators in Russia and then the values Reg_1-Reg_3 are replaced with maximum possible ones (100 points), and we determine the change in other indicators connected with it. The forecast is focused on the perspective of the Decade of Science and Technologies in Russia (2031). We used the method of trend analysis to find the change in the values of the indicators in 2031 compared to 2023, according to the forecast (Figure 4).

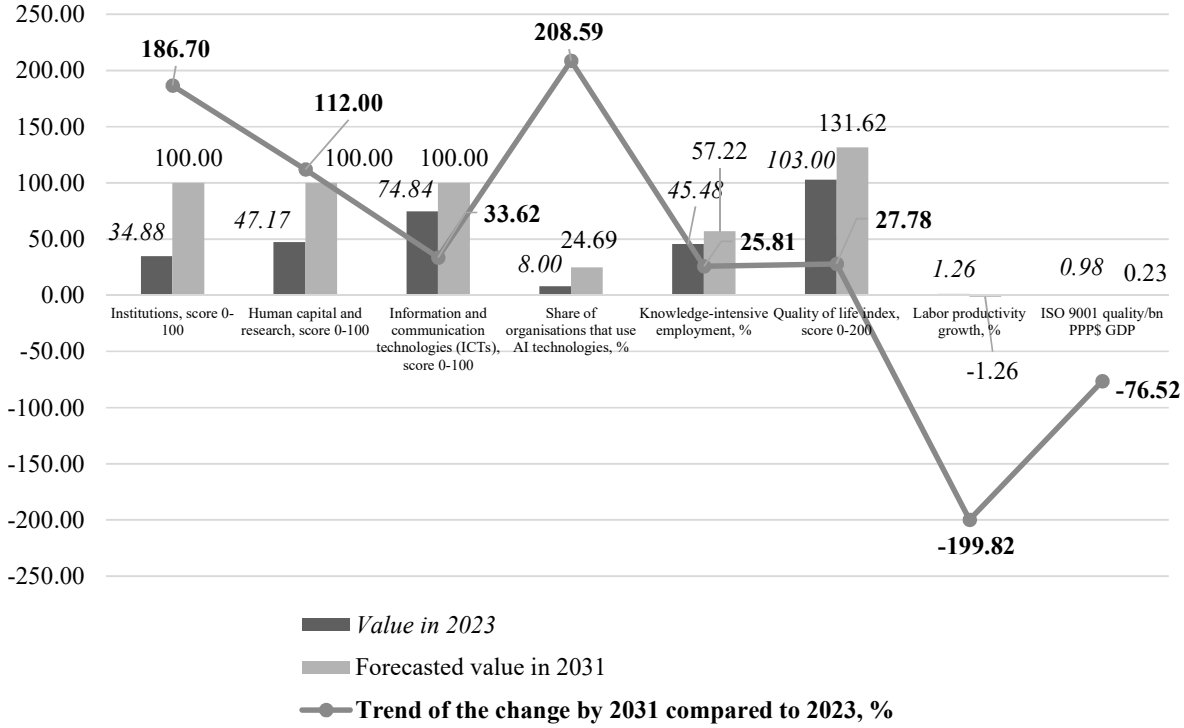

Figure 4. Perspective of AI economy development in Russia in the Decade of Science and Technologies (until 2031)
Source: Calculated and built by the authors based on the authors' forecast.

The perspective of the development of the AI economy in Russia в the Decade of Science and Technologies (until 2031), which was demonstrated in Figure 4, first, determines the potential of the development of the AI economy through the improvement of state regulation. In case of the maximum favourable (100 points) institutional (+186.70%), as well as personnel and technological support (+112.00%), for the dissemination of AI and the highest level of development of telecommunication infrastructure (+33.62%), according to the forecast by 2031, there will be an increase in the share of organisations that use AI technologies in Russia up to 24.69%, that is, by 208.59% compared to 2023, when their share equalled 8.00%.

Second, the revealed perspective showed advantages for the development of the AI economy. Due to the above increase in the share of organisations that use AI technologies in Russia up to 24.69%, the following advantages were forecasted:

- Growth of the share of knowledge-intensive employment up to 57.22%, i.e., by 25.81% compared to 45.48% in 2023;
- Increase in the quality of life up to 131.62 points, i.e., by 27.78% compared to 103.00 points in 2023.

Third, the revealed perspective showed the risks of the development of the AI economy. The above increase in the share of organisations that use AI technologies in Russia up to 24.69% is connected with the following risks, according to the forecast:

- Risk of the slowdown of the growth rate of labour productivity down to -1.26%, i.e., by 199.82% compared to 1.26% in 2023;
- Risk of the reduction of quality of products down to 0.23 bn PPP$ GDP, i.e., by 76.2% compared to 0.98 bn PPP$ GDP in 2023

5. DISCUSSION

The contribution of this paper to the development of the provisions of the existing literature on the topic of the AI economy (Guerreiro Augusto et al., 2024; Lanzalonga et al., 2024) consists in determining its unique Russian model and substantiation of its specifics (Table 9).

Table 9. The Russian model of the AI economy compared to the models from the international experience (in the existing literature)

Spheres of comparison		Model from the international experience	Russian model
Implications of the AI economy	For labour productivity	advantage (Tokunova et al., 2023)	risk (b=-0.0193)
	For knowledge-intensive employment	advantage (Zhang, 2023)	advantage (b=0.6526)
	For the complexity of manufactured and exported products	advantage (Lu et al., 2024)	absence of interconnection
	For the quality or product	advantage (Woźniak et al., 2022; Zimon et al., 2022)	risk (b=-0.5915)
	For environmental costs of economic growth	risk (Hong and Xiao, 2024)	absence of interconnection
	For the quality of life	advantage (Matytsin et al., 2023)	advantage (b=2.6143)
Factors of the evelopment of the AI economy	Institutional support for the AI economy	(Samothrakis, 2024)	insignificant factor (b=0.0469)
	Personnel and technological support for the dissemination of AI	(Cramarenco et al., 2023)	key factor (b=1.1405)
	Telecommunication infrastructure in support of the implementation and application of AI technologies	(Schmitt, 2023)	secondary factor (b=1.1307)

Source: Authors.

As shown in Table 9, unlike Tokunova et al. (2023), the AI economy creates not only advantages but risks for labour productivity. Confirming Zhang (2023), the AI economy creates advantages for knowledge-intensive employment. Unlike Lu et al. (2024), the AI economy does not influence the complexity of manufactured and exported products.

Unlike Woźniak et al. (2022) and Zimon et al. (2022), the AI economy creates not only advantages but risks for the quality of products. Unlike Hong and Xiao (2024), the AI economy does not influence the environmental costs of economic growth. Confirming Matytsin et al. (2023), the AI economy creates advantages for the quality of life.

Unlike Samothrakis (2024), institutional support for the AI economy is an insignificant factor in the AI economy. Confirming Cramarenco et al. (2023), personnel and technological support for the dissemination of AI is the key factor of the AI economy. Unlike Schmitt (2023), telecommunication infrastructure in support of implementing and applying AI technologies is a secondary factor of the AI economy.

6. CONCLUSION

As a result of the conducted research, we revealed the trends of the AI economy in Russia, which demonstrate the following features of the Russian model of this economy. The first feature is that in Russia, the key participant of the AI economy is the government, which activity is assessed at 61.48 points in 2022, but it is changeable (which is shown by the downward trend in 2022 compared to 2021: -0.73%). Though business is a secondary player in the AI economy in Russia (its activity is assessed at 6.6% in 2022), its role is growing more and more (which is shown by an upward trend in 2022 compared to 2020: +22.22%).

The second feature is that Russia successfully strengthens its technological sovereignty in the sphere of the AI economy. This is shown by a range of trends: 1) the trend of the growth of the number of developed AI technologies in Russia in 2022 compared to 2018, by 406.25%; 2) the trend of an increase in the share of Russian AI technologies that are unparalleled in the world, by 111.27%; 3) trend of an increase in the number of publications of Russian authors on the topic of AI in

Scopus-indexed publications in 2022 compared to 2010, by 1995.74%; 4) trend of the growth of the share of Russia in the world total number of publications on the topic of AI in Scopus-indexed publications in 2022 compared to 2010, by 600%.

The main conclusion of this paper is that the AI economy has not only advantages but also risks, which are specific to its various models. In the Russian model, the advantages of the AI economy are connected with the growth of the share of knowledge-intensive employment and an increase in the quality of life, and its risks consist in a possible slowdown of the growth rate of labour productivity and reduction of the quality of products.

The theoretical significance of the authors' conclusions is that they allowed for the systematisation of trends and, due to this, the determination of the outlines of the unique Russian model of the AI economy. The managerial significance of the paper is that the compiled econometric model allowed for systematisation and generalisation of the leading experience of the top-30 AI economies in the world in 2023, mathematical presentation and, thus, quantitative measuring (with high precision) of the cause-and-effect relationships of the AI economy development. Due to this, the developed model raises the predictability and manageability of the AI economy.

The practical significance is that the compiled authors' forecast outlines the perspective of the development of the AI economy in Russia in the Decade of Science and Technologies. This forecast disclosed highly probable future trends of the AI economy in Russia. It demonstrated the expected return from the implementation of managerial measures and presented, in quantitative measuring, the expected advantages and risks of the development of the AI economy in Russia until 2031. The forecast could be used during the preparation of a "roadmap" and the development and implementation of the state policy in the sphere of regulation of the AI economy in Russia.

It should be noted that the authors' conclusions and recommendations are mainly focused on Russia's experience, which is a limitation of this research. Future scientific studies should pay attention to the identification of trends of the AI economy in other countries, in particular, from the top 50, determination of their specific features, compilation of forecasts of their development, and preparation of recommendations for their regulation to maximise the obtained advantages and level the risks of the AI economy development in each country given its specifics.

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