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THE SYSTEM APPROACH TO THE SUSTAINABLE DEVELOPMENT OF THE HEALTHCARE ECONOMY BASED ON TELEMEDICINE: LEADING EXPERIENCE AND PERSPECTIVE OF RUSSIA

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A B S T R A C T

This paper is devoted to identifying opportunities for improving the management of telemedicine and compiling recommendations for implementing these opportunities in support of the sustainable development of the Russian healthcare economy. For this, we study the statistical data on the level of the development of telemedicine and the sustainability of healthcare in Russia in 2015-2025. A case overview of the Russian market of telemedicine from the position of sustainability of the healthcare economy was performed. It demonstrated that Russia is behind global leaders in the share of patients treated by doctors through telemedicine. Second, an economic and mathematical model of the sustainable development of the healthcare economy in Russia based on telemedicine was compiled. It demonstrated the mutual dependence of the organisational & economic, financial & regulatory, and innovative & technological aspects during this development. This model revealed opportunities for improving the management of telemedicine in Russia, connected with an increase in the volume of investments in digital healthcare and optimisation of the organisational & technological scheme of using these investments. A conclusion is made that optimisation of government budget financing and more intense stimulation of the inflow of private investments in digital healthcare, including telemedicine, will allow expanding the use of cloud services, data processing centres, and RFID technology in telemedicine and, subsequently, raising the number and share of provided telemedicine services in the structure of medical services, increasing the efficiency of pricing of telemedicine services, and reducing their cost, as well as supporting ICT employment in the sphere of telemedicine. To improve the management of telemedicine in Russia, we offer a system approach to this management, which supports the sustainable development of the healthcare economy based on telemedicine and includes applied solutions for Russia. The advantage of the new approach is the improvement of coordination of the organisational & economic, financial & regulatory, and innovative & technological aspects during the development of telemedicine. Transitioning to the new approach will allow reaching the global leadership of Russia in the sphere of telemedicine.

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1. INTRODUCTION

The healthcare economy has drawn the attention of the modern global community, including academics, with the start of the COVID-19 pandemic and crisis in 2020, and remains the focus of many scientific studies conducted around the world. The increasing number of zoonotic diseases, which grow under the influence of climate change, leads to a large acuteness of the problem of the possible start of new epidemics and pandemics in the future. That is why sustainable development of healthcare has been included among the top 3 UN SDGs (SDG 3).

Sustainability of healthcare is treated as accessibility of medical services, which must be general, from the position of the speed of their provision and convenience of their receipt with the high quality of these services from the position of improvement of health and longevity of patients as consumers of the considered services. A serious contribution to the achievement of this was made by the establishment of telemedicine as a new form of medical services. Telemedicine is seen as digital medical services that are provided remotely, i.e., with geographical remoteness and the use of the Internet by doctors and patients.

Multiple advantages of telemedicine determine its important role in the sustainable development of the modern healthcare economy. One of these advantages is an expansion of the access of remote and rural territories to medical services, as well as an increase in the quality of the services provided in these territories. Another advantage lies in the possibility of doctors' uniting in councils for joint treatment of patients in case of complex diseases, to optimise the outcome of treatment.

Another advantage is more complete information support of the process of receiving medical services with the help of electronic medical records. One more positive aspect of telemedicine is that it allows dealing with queues and reducing the time between patients applying for medical services and to physical provision of these services. Among the described advantages, an important place belongs cheapening of medical services due to the transition to telemedicine.

However, despite the mentioned range of advantages, the potential for the sustainable development of the healthcare economy based on telemedicine is not fully developed in Russia due to an imperfect approach to the management of telemedicine. The piecemeal approach, which formed under the influence of the government initiative (Government of the Russian Federation, 2025) since 2023, envisages separate management of organisational & economic, financial & regulatory, and innovative & technological aspects during the development of telemedicine in Russia.

Insufficient coordination of the above aspects slows down the progress of telemedicine and restricts its contribution to the sustainable development of healthcare. Acknowledging the relevance of this problem and striving towards a contribution to its resolution, this paper aims to reveal the opportunities for improving the management of telemedicine and developing recommendations to implement these opportunities in support of the sustainable development of the healthcare economy in Russia.

2. LITERATURE REVIEW

The scientific basis of the conducted research is the concept of sustainability of the healthcare economy, disclosed in the works by Litvinova (2022), Popkova and Giyazov (2021), and Tovmasyan et al. (2022). The main criteria for the sustainability of telemedicine as a sphere of the healthcare economy, which is growing quickly and ousting other spheres from it, are as follows:

– Support of employment in the sphere of healthcare (Yuldashev et al., 2024);
– Increase in the volume of telemedicine services market in the measuring from the position of the number of provided services and their cost (Benčič et al., 2020);
– Growth of the high-tech character of healthcare (Veselovsky et al., 2017).

The literature review allowed revealing three aspects of the development of telemedicine, which are managed in isolation within modern Russia's piecemeal approach to the management of its development:

– Organisational and economic aspects, connected with an increase in the number and share of provided telemedicine services in the structure of medical services (Vasilikhina, 2025) and organisation of ICT employment in the sphere of telemedicine (Bogoviz et al., 2018);
– Financial and regulatory aspects, consisting in government budget financing and stimulation of the inflow of private investments in digital healthcare, including telemedicine (Margaryan and Margaryan, 2022), as well as pricing of telemedicine services in the reduction of their cost (Kurolov, 2022);
– Innovative and technological aspects, connected with the use of such digital technologies as cloud services (Przhedetsky et al., 2019), data processing centres (Przhedetsky et al., 2021), the Internet of Things (Lobova et al., 2020), and RFID technology (Ergasheva et al., 2023) in telemedicine.

Due to the fragmentary character of the previous scientific studies, the interconnection between the above aspects of telemedicine development has not been sufficiently studied and remains unknown; the same is true for their contribution to the sustainable development of the healthcare economy based on telemedicine. This leads to the following research question: how does the volume of investments in digital healthcare influence the application of various technologies (in particular, cloud services, data processing centres, the Internet of Things, and RFID technology) and the volume of telemedicine market and ICT employment in healthcare in Russia?

3. MATERIALS AND METHODOLOGY

This research consists of three stages. 1st stage: an overview of the Russian market of telemedicine from the position of sustainability of the healthcare economy. For this, we perform a case study of the Russian market of telemedicine services and a comparative analysis of the share of medical services provided with the help of telemedicine in Russia and the leading countries by the level of telemedicine development in 2024.

2nd stage: based on the statistics for the last decade (2015-2024) from Table 1, an econometric model of the sustainable development of the healthcare economy in Russia based on telemedicine is compiled. For this, the method of regression analysis is used to find the following interconnections:

- Dependence of the number of telemedicine consultations (Toe_1) and the value of the telemedicine market (Tfr_1) according to Delprof (2025) on the level of using such digital technologies as cloud services (Tit_1), data processing centres (Tit_2), the Internet of Things (Tit_3), and RFID technology (Tit_4) according to HSE (2025) in telemedicine;
- Dependence of the level of using such digital technologies (Tit_{1-4}) in telemedicine on the volume of investments in digital healthcare (Tfr_2) according to Webiomed (2025);
- Dependence of the share of employees (ICT specialists) at workplaces with the intense use of ICT (Toe_2) according to HSE (2025) on Toe_1 and Tfr_1.

Table 1. The level of development of telemedicine and the sustainability of healthcare in Russia in 2015-2024

Year	Number of telemedicine consultations, million	The volume of the telemedicine market, RUB million	The volume of investments in digital healthcare, $ million	Share of healthcare organisations using				Share of employees with intense use of ICT, %
				Cloud services, %	Data processing centres, %	Internet of Things, %	RFID technology, %	
	Toe_1	Tfr_1	Tfr_2	Tit_1	Tit_2	Tit_3	Tit_4	Toe_2
2015	0.06	23.87	0.2	25	9.2	13.8	4.1	2.5
2016	0.12	375.26	13.9	26.6	9.2	13.8	3.5	2.5
2017	0.18	2,677.2	34.1	29.5	9.2	13.8	3.8	2.5
2018	0.51	3,735	14.9	31.2	9.2	13.8	4.2	2.5
2019	1.07	4,399.1	15.8	34.5	9.2	13.8	4.4	5.2
2020	4.51	9,330.5	47.3	32.6	9.2	13.8	8.5	5.2
2021	4.95	15,022.1	147.4	64	15.4	15.1	9.8	5.2
2022	5.21	18,086.6	26.3	36.3	16.6	11.4	8.3	5.2
2023	6.11	46,630	12.4	36.3	16.6	11.4	8.3	5.2
2024	17.5	100,000	2.8	36.3	16.6	11.4	8.3	5.2

Source: *Compiled by the author based on Delprof (2025), HSE (2025), and Webiomed (2025)*

3rd stage: development of the system approach to the sustainable development of the healthcare economy based on telemedicine and applied solutions for its application in Russia in the Decade of Action. For this, the obtained econometric model is used to select the amount of investments in digital healthcare and the organisational and technological scheme of using these investments at which the aggregate volume of the market of telemedicine services and ICT employment in digital healthcare in Russia are maximised by 2030.

4. RESULTS

4.1. Case overview of the Russian market of telemedicine: a view from the position of the healthcare economy's sustainability

The performed case study of the Russian market of telemedicine services allowed compiling its quantitative and qualitative characteristics (HSE, 2025):

- 36% of the Russian population use the Internet to choose or receive telemedicine services, while this number is 81 % in Cyprus, 75 % in Denmark, and 50 % in Germany;
- 36% of Russian population use the Internet for electronic appointment to the doctor, while this number is 68 % in Denmark, 58 % in Spain, and 7 % in Cyprus;
- Healthcare organisations in Russia use disruptive digital technologies with the following activity: big data – 30.6 %, digital platforms – 16.1%, geoinformation systems – 13.0%, artificial intelligence – 5.5%, and industrial robots – 1.2%.

Comparative analysis based on the materials of the international statistics from Statista (2025) and Russian Delprof (2025) showed that the share of medical services provided with the help of telemedicine in 2024 was as follows:

- The share of patients received by doctors via telemedicine is at the level of 1-25% in Australia, Germany, the USA, France, and Switzerland; 25-75% – in Sweden, Canada, and the Netherlands; and more than 75% – in the UK and New Zealand;
- In Russia, the share of patients received by doctors via telemedicine is at the level of 30% and is growing fast.

Thus, the performed overview of the Russian market of telemedicine from the position of sustainability of the healthcare economy demonstrated that this market in Russia is slightly behind the level of the leading countries

in the development of telemedicine and has a large potential for further development, which allows reaching the global leadership of Russia in the sphere of telemedicine.

4.2. The model of the sustainable development of the healthcare economy in Russia based on telemedicine

Based on the data from Table 1, which were processed with the help of the regression method analysis, an econometric model of the sustainable development of the healthcare economy in Russia based on telemedicine was created. The model contains, first, the dependence (presented by equations (1) and (2)) of the volume of the telemedicine markets on the level of usage of various digital technologies in telemedicine:

$$Toe_1=22.69+0.06Tit_1+0.04Tit_2-2.01Tit_3+0.87Tit_4 \quad (1)$$

$$Tfr_1=166,263.35+439.14Tit_1+1,404.07Tit_2-14,114.72Tit_3+1,241.17Tit_4 \quad (2)$$

The established dependence, expressed in equations (1) and (2), showed that the growth of the share of organisations using cloud services by 1 % leads to an increase in the number of telemedicine consultations by 0.06 and of the value of the telemedicine market by RUB 439.14 million. An increase in the share of organisations using data processing centres of 1 % leads to an increase in the number of telemedicine consultations of 0.04 and the value of the telemedicine market of RUB 1,404.07 million.

An increase in the share of organisations using RFID technology of 1 % leads to an increase in the number of telemedicine consultations of 0.87 and the value of the telemedicine market of RUB 1,241.17 million. Healthcare organisations using the Internet of Things does not allow increasing the volume of telemedicine market, so this technology is not considered further in this paper.

Second, the dependence (presented by the equations (3)-(5)) of the level of using digital technologies in telemedicine digital technologies on the volume of investments in digital healthcare:

$$Tit_1=28.12+0.23Tfr_2 \quad (3)$$

$$Tit_2=11.43+0.02Tfr_2 \quad (4)$$

$$Tit_4=+5.36+0.03Tfr_2 \quad (5)$$

The revealed dependence, which is expressed in equations (3)-(5), showed that the growth of the volume of investments in digital healthcare by $1 million contributes to an increase in the share of organisations using cloud services of 0,23 %, data processing centres – 0.02 %, and RFID technology – 0.03 %. Third, the dependence of the share of employees at workplaces with intense use of ICT on the volume of the telemedicine market:

$$Toe_2=3.32+0.47Toe_1-0.00005Tfr_1 \quad (6)$$

The revealed dependence, expressed in equation (6), showed that an increase in the number of telemedicine consultations of 1 leads to an increase in the share of employees at workplaces with intense use of ICT of 0.47%. At the same time, the growth of the value of the telemedicine market by RUB 1 million contributes to the reduction of the share of employees at workplaces with intense use of ICT of 0.00005%.

Thus, the compiled model confirmed the significant contribution and disclosed quantitative regularities of the sustainable development of the healthcare economy in Russia based on telemedicine.

4.3. The system approach to sustainable development of the healthcare economy based on telemedicine and applied solutions for its application in Russia

To raise the sustainability of the healthcare economy in Russia, a system approach to the development of telemedicine is offered. It involves a complex interconnection of the organisational & economic, financial & regulatory, and innovative & technological aspects during this development. Applied solutions for the application of the author's approach in the Decade of Action in Russia are shown in Fig. 1. For these solutions, we used the equations (1)-(6) to select the most optimal volume of investments in digital healthcare and the most optimal organisational and technological scheme of using investments.

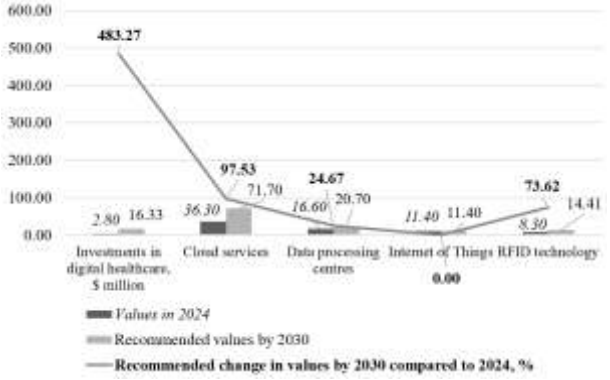

Figure 1. Investment support and the organisational & technological scheme of telemedicine development in Russia by 2030

Source: Calculated and created by the author

As shown in Fig. 1, the recommended growth of the amount of investments in digital healthcare by 483.27 %: from $2.80 million in 2024 to $16.33 million by 2030 will ensure the following (with the stable share of healthcare organisations using the Internet of Things):

- An increase in the share of healthcare organisations using cloud services of 97.53 %: from 36.30% in 2024 to 71.70 % by 2030;
- Growth of the share of healthcare organisations using data processing centres by 24.67 %: from 16.00 % in 2024 to 20.70% by 2030;
- An increase in the share of healthcare organisations using RFID technology by 73.62 %: from 8.30% in 2024 to 14.41 % by 2030.

The advantages of the implementation of the author's recommendations for improving telemedicine

management for the sustainable development of healthcare in Russia are demonstrated in Fig. 2.

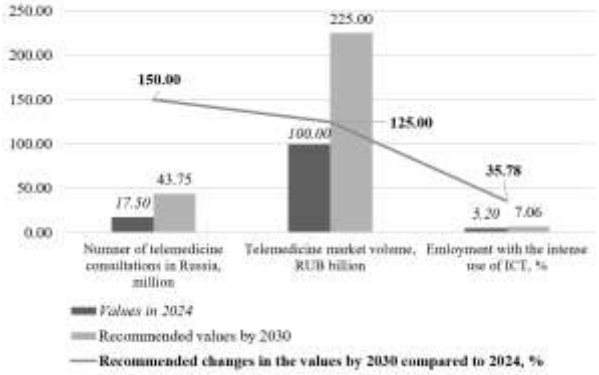

Figure 2. Perspective of raising the sustainability of healthcare in Russia based on telemedicine development by 2030

Source: *Calculated and created by the author*

As shown in Fig. 2, due to the practical implementation of the author's suggestions on the improvement of telemedicine management, the sustainability of the healthcare economy in Russia will grow in the following way:

- An increase in the number of telemedicine consultations of 150.00 %: from 17.50 million in 2024 to 43.75 million by 2030;
- An increase in the value of the telemedicine market of 125.00 % of RUB: from 100.00 million in 2024 to RUB 225.00 million by 2030;

This will allow achieving an increase in the share of employees at workplaces with intense use of ICT in healthcare of 35.78%: from 5.20% in 2024 to 7.06% by 2030.

Thus, the developed system approach to the sustainable development of the healthcare economy based on telemedicine and applied solutions for its application in Russia in the Decade of Action will allow maximising the aggregated volume of the telemedicine services market and ICT employment in digital healthcare in Russia by 2030. This will allow increasing the share of telemedicine in the total structure of medical services in Russia by 2.5 times: from 30% in 2024 to 75% and bringing it up to the level of global leadership by 2030.

5. DISCUSSION

The paper's contribution to the literature by Litvinova (2022), Popkova and Giyazov (2021), and Tovmasyan et al. (2022) is manifested in supplementing the concept of sustainability of the healthcare economy with an improved understanding of the interconnection of the above aspects of telemedicine development; however, their role has not been sufficiently studied and remains unknown, and the same is true for their contribution to the sustainable development of the healthcare economy based on telemedicine.

A series of research by Kurolov (2022) and Margaryan and Margaryan (2022) is continued by the proposed system approach to the sustainable development of the healthcare economy based on telemedicine. Unlike Bogoviz et al. (2018) and Vasilikhina (2025), it was established that in the course of an increase in the number and share of provided telemedicine services in the structure of medical services, ICT employment in the sphere of telemedicine has not decreased but increased under the condition of the high-tech character of telemedicine.

Unlike Lobova et al. (2020), it was proven that the application of the Internet of Things by healthcare organisations does not contribute to the development of the telemedicine market in Russia. At the same time, it was proven that the dissemination of such digital technologies as cloud services (which agrees with Przhedetsky et al., 2019), data processing centres (which agrees with Przhedetsky et al., 2021), and RFID technology (which agrees with Ergasheva et al., 2023) raises the number and value of the provided telemedicine services.

It was confirmed that development of telemedicine raises the sustainability of the healthcare economy through stimulation of employment in the healthcare sphere (which agrees with Yuldashev et al., 2024), increase in the volume of the telemedicine services market measured from the position of the number of provided services and their cost (which agrees with Benčič et al., 2020), and the growth of the high-tech character of healthcare (which agrees with Veselovsky et al., 2017).

Thus, a scientifically justified answer to the research questions was provided: the growth of the volume of investments in digital healthcare stimulates the application of various technologies (in particular, cloud services, data processing centres, and RFID technology), raising the volume of the telemedicine market and supporting ICT employment in healthcare in Russia.

6. CONCLUSION

Thus, as a result of the research, the following main results were received. First, the performed case overview of the Russian telemedicine market from the position of sustainability of the healthcare economy showed that the share of patients received by doctors via telemedicine in Russia was at the level of 30 % in 2024. By this indicator, Russia is behind global leaders. Regression analysis allowed compiling an economic and mathematical model of the sustainable development of the healthcare economy in Russia based on telemedicine, which demonstrated mutual dependence on the organisational & economic, financial & regulatory, and innovative & technological aspects during this development. The model revealed opportunities for improving the management of telemedicine in Russia, connected with an increase in the volume of investments in digital healthcare and optimisation of the organisational & technological scheme of using these investments.

The theoretical significance of the compiled model is due to it explaining the logic of change in the activity of using

various technologies (in particular, cloud services, data processing centres, the Internet of Things, and RFID technology) and the volume of telemedicine market and ICT employment in healthcare in Russia in the course of an increase in the investments in digital healthcare.

The main conclusion of this paper is that optimisation of government budget financing and more intense stimulation of the inflow of private investments in digital healthcare, including telemedicine, will allow expanding the use of cloud services, data processing centres, and RFID technology in telemedicine and, therefore, raising the number and share of provided telemedicine services in the structure of medical services, increasing the efficiency of telemedicine services pricing and reducing their costs, as well as supporting ICT employment in the sphere of telemedicine.

Third, to improve the management of telemedicine in Russia, a system approach to this management was proposed. It supports the sustainable development of the healthcare economy based on telemedicine and includes applied solutions for Russia. The advantage of the new approach is that it achieves the improvement of coordination between the organisational & economic, financial & regulatory, and innovative & technological aspects during the development of telemedicine.

The author's recommendations for implementing the opportunities for the development of telemedicine in support of strengthening the sustainability of the healthcare economy in Russia include an increase in the share of healthcare organisations using cloud services, data processing centres, and RFID technology during the provision of telemedicine services. The practical significance of the formulated offers is that their implementation will support the realisation of the Programme of the Government of the Russian Federation (2025) of the experimental legal regime in the sphere of digital innovations in medical activities, including the application of telemedicine technologies.

A limitation of the results obtained is the established absence of the positive contribution of the use of the Internet of Things by medical organisations to the sustainable development of healthcare in Russia in 2015-2024. Future scientific works should specify whether this contribution is observed in other periods and other countries, to exclude spatial and time distortions of the compiled model of the sustainable development of the healthcare economy in Russia based on telemedicine.

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