**ANNOTATION**
**to the dissertation work of Bitenova Bagdat Sabitovna on the topic:**
**« Improving the efficiency of digitalization of healthcare in the Republic of Kazakhstan (on the example of the Karaganda region)»,**
**presented for the doctor of philosophy degree (PhD)**
**by specialty 6D050600- «Economics»**

**Relevance of the research topic**. In the President's Message, " A Fair State. One Nation. Prosperous Society" from September 1, 2022 says that people are the main value of our country. The President pays special attention to the comprehensive improvement of the medical infrastructure, which includes digital technologies.

The successful implementation and realization of digitalization in healthcare ensures a high quality of life and the development of affordable and high-quality medical services defined in accordance with the needs of society, the medical services market and a particular patient.

The ability to work with the help of digital technologies makes it possible to carry out holistic work with patients more quickly, more accessible and without significant delays. And in the current post-pandemic conditions, the introduction of digital technologies will also significantly reduce the spread of various types of viruses.

MedTech (technological development of the healthcare system) is one of the three priority technological directions of the Digital Transformation Concept, the development of the information and communication technologies and cybersecurity industry for 2023-2029.

To date, the issues of digitalization of healthcare are also reflected in "The Concept of healthcare development of the Republic of Kazakhstan until 2026".

Kazakhstan pays a lot of attention to developments and resources that contribute to the development of digitalization in the healthcare sector. The root cause of the need to introduce digital technologies is globalization, maximum integration of the economy and political system of Kazakhstan into the common world space. In order to maximize the benefits of the globalization process, it is most important to create such conditions so that digital technologies can be introduced as quickly as possible into key sectors of the state, especially in healthcare.

Life expectancy is gradually getting longer, technology is improving, and medicines are spreading at an incredible rate. The benefits are undeniable, there are as many problems as questions. The evolution of healthcare is, first of all, the evolution of a way of thinking: health should be considered as a social and economic investment, an engine of growth that ensures circular well-being among those who provide technological equipment, those who use it in emergency situations and providing routine care, as well as those who receive care, that is, patients. The starting point can only be costs, human and economic: healthcare will be sustainable if business models that improve the quality of service do not increase costs already at the limit of their availability. This is not an easy task, given the growing demand for medical care, due to the increase in the number of patients and new services, treatment methods and monitoring.

Also, the expected results can include an obvious reduction in duplication of documents, increased efficiency of work processes, improved integration in functional areas of hospitals, increased availability of patient information, reduced risks, cost and time savings.

Therefore, the relevance of the chosen topic is due to the fact that accelerated digitalization is currently taking place in various fields and spheres, for accuracy, including in the healthcare system. This, in turn, requires a methodological framework for assessing the economic efficiency of investments in digitalization projects.

Evaluation of the effectiveness of digitalization and the problem of its increase provides great opportunities in the strategic management of the industry, can ensure continuous monitoring and analysis of its internal resources (material, human, intellectual, etc.) and external opportunities and threats to make the right management and medical decisions.

**The degree of scientific development of the research topic.** Digital transformation in healthcare is becoming increasingly relevant not only for the government, doctors and patients, but also for scientists. Foreign research in this field can be divided into several segments: patient-oriented research; organizational and managerial significance and socio-economic aspects.

Digitalization of healthcare, understood as the use of information technologies for processing and managing data, information and processes, became popular in the early 2000s.

But steadily growing interest in this field of research has been observed since 2015, which peaked in 2019.

The works of foreign scientists S.R. Agnihotri, L. Tsui, M. Delasey , B. Rajan, S.R. Mishra, K. Ligidakis, D. Neupane, B. Giavali, Y.P. Uvizihive, S.S. Virani, J. Miranda, P. Gray, O. A. El Savi, G. Asper, M. Thordarson, L. Patricio, J. G. Teixeira, J. Vinck, K. Yousaf, Z. Mehmood, I. A. Awan, T. Saba, R. Alkharbey, T. Kada, M.A. Alrij, N. Hikmet, A. Bhattaherjee, N. Menahemi, V.O. Kayhan, R.G. Brooks, J.M. Saddon, V.L. Curryare devoted to the issues of digitalization of healthcare.

Among the researchers of the post-soviet countries in the field of digitalization of healthcare, one can single out the works of Kovalev V.P., Vitrenko A.A., Vinogradov K.A., Kutushev T.S., Birger E.V., Gnezdovaya Yu.V., Myzrova K.A., Tuganova E.A., Korobkova O.K., Morozova Yu.A., Smotrova T.I., Monakhova D.N., Proncheva G.B., Krasnova S.V., Krasnova S.A. and others.

Among national researchers on the topic of digitalization, such scientists as Alimbayev A.A., Arynova Z.A., Baizholova R.A., Kireeva A.A., Ziyadin S.T., Kurmangalieva A.K., Baeshova M.U., Ismailova D.Sh., Aubakirova A.T., Kurmanova G.K., Sukhanberdina B.B., Sarsenova A.O. and others are engaged.

A review of existing studies has shown that they are mostly based on qualitative studies focused on hospitals as primarily analyzed healthcare institutions and patients. The issues of the effectiveness of digitalization of healthcare are considered only in relation to consumers and suppliers in general terms. The impact of digitalization of healthcare on the economic and social sphere at the country level is

considered superficially, and therefore, the topic of our research has scientific interest.

**The goal of the dissertation** is to study the theoretical and methodological foundations of digitalization of healthcare, as well as the development of scientific and practical recommendations to improve its effectiveness in the Republic of Kazakhstan.

**Tasks** of the dissertation work:

- To investigate and develop general theoretical approaches to the definition of the categories "digital economy" and "efficiency of digitalization of healthcare"
- To determine the essence, content and prerequisites of digitalization of healthcare
- Analyze the existing methods of evaluating the effectiveness of digitalization and propose a methodology for evaluating the digitalization of healthcare in the Republic of Kazakhstan
- To study the international experience of digitalization of healthcare
- To assess the socio-economic effect of digitalization of healthcare in the Karaganda region
- Develop recommendations to improve the efficiency of digitalization in the healthcare sector of the Republic of Kazakhstan

**The object** of the study is the healthcare services of the Republic of Kazakhstan provided by the public sector.

**The subject** of the study is a set of organizational and economic relations arising in the process of digitalization of healthcare in the Republic of Kazakhstan.

**The theoretical and methodological basis** of the dissertation research was made up of scientific works of domestic, Russian and foreign researchers and specialists in the field of economic theory, management theory, digital economy theory, innovation management, as well as scientific and practical developments in the field of innovative development based on digital technologies. In the course of the research, various theories and methods, foreign and domestic experience were studied, as well as data from scientific and practical conferences, periodicals in the field of digitalization problems were generalized and systematized. During the research period, such general scientific methods as analysis, synthesis, comparison, survey and others were used. Methods of economic and mathematical modeling, the method of expert assessments, statistical and graphical methods were also used.

**The information base of the dissertation research** was the scientific works of foreign and local scientists in the field of digital economy and digitalization of healthcare. In the course of the work, legislative and regulatory acts in the field of healthcare of the Republic of Kazakhstan, official publications, analytical and statistical collections of the Ministry of Health of the Republic of Kazakhstan were used, state programs, concepts and strategies for the development of healthcare of the Republic of Kazakhstan were studied. The work used data from international indicators of economies of different countries, data from the results of an expert survey, as well as Internet information resources on the problem under study.

**Scientific novelty of the dissertation research.** The most significant results containing scientific novelty and submitted for defense include the following:

- as a result of the literature review, the author clarified the concept of "digital economy" and "efficiency of digitalization of the healthcare system";

- based on the theory of efficiency, the methodology for assessing the social and economic effect of digitalization of healthcare has been adapted;

- the methodology of socio-economic efficiency from digitalization of healthcare in the Karaganda region has been tested;

- recommendations have been developed to improve the efficiency of digitalization of healthcare in the Republic of Kazakhstan based on the development of public-private partnership.

**The main provisions of the dissertation research submitted for defense:**

1) the definition of the concepts of "digital economy", "efficiency of digitalization of the healthcare system" has been clarified;

2) methodology for assessing the socio-economic efficiency of digitalization of healthcare, based on time savings and conditionally fixed costs;

3) the results of the assessment of the socio-economic effect of digitalization of healthcare in the Karaganda region;

4) recommendations on improving the efficiency of digitalization of healthcare in the Republic of Kazakhstan.

**Theoretical and practical significance of the dissertation research**.

The theoretical significance of the dissertation research lies in the possibility of applying theoretical and methodological provisions in the study of such disciplines as "Health Economics", "Digital Economy", "Social Economics". The practical significance of the study lies in the possibility of applying the recommendations in the practical activities of public health institutions and in private structures that are engaged in servicing the healthcare sector.

**Approbation and implementation of research results**. The main results of the dissertation work were published in 12 papers. Of these, 1 is a paragraph in a collective monograph, 7 articles are in collections of scientific international practical conferences (5 in foreign, 2 in Kazakhstan), 3 articles are in publications recommended by the KKSON of the Ministry of Education and Science of the Republic of Kazakhstan, 1 article is in a journal from the Scopus database list.

**The structure and scope of the dissertation**. The dissertation work consists of three sections, 15 tables, 40 figures, conclusions, 144 sources used and 4 appendices.

**In the first chapter of the dissertation** "Theoretical and methodological foundations of the study of digitalization of healthcare", the stages of economic development in the process of technology and innovation implementation are considered.

After reviewing the interpretations of the digital economy proposed in the scientific literature, we can single out the basic component of all definitions – the availability of information and communication technologies.

In our opinion, the digital economy cannot be considered exclusively in the form of the digitalization of ICT. A broader approach is needed.

In our understanding, the *digital economy* is an element of social relations and an integral part of the development of society based on the use of information and

communication technologies that create conditions to meet the needs of the individual, social groups and society as a whole. Being an element of the system of social relations and an integral part of the development of society, it is itself a system.

At the moment, the issue of assessing the economic, social and other types of effects from the processes of digitalization of the economy remains difficult and open. When developing a methodology for evaluating digitalization, we formulated the basic principles:

It is important to understand that digitalization is an exceptional information product. This is an immaterial development system, therefore, the evaluation of such a resource depends on completely different factors. First of all, this concerns the possibility of determining the direction of resources to improve the quality of medical work in relation to time optimization. Simply put, this is the ratio of increasing the productivity of medical institutions to reducing time spent. Such an assessment strategy reveals one of the key and main features of the digital space – immateriality.

Saving time and improving the quality of healthcare. A time resource is also of great importance as a controlling one. Its essence is to demonstrate the effectiveness of the implemented technologies in relation to time. Conditionally, a certain period of time is taken when digitalization has been successfully implemented and a similar time period is taken before the introduction of new working methods. The importance of time has been repeatedly mentioned in the works of K. Marx. His law is that any savings will always come down to saving time. Even during the introduction of digitalization, we can safely declare the truthfulness of such a hypothesis. All efforts and innovations will be focused on saving more time, while not losing, or even improving the very quality of health services.

The principle of advance. As analytical capabilities and technologies evolve and are introduced into healthcare systems, organizations can use predictive analytics tools to quickly identify which patients are most at risk, inform decisions about health care priorities to reduce or mitigate risk before they become ill, and ensure medical care is provided by providing the best possible care to maintain or strengthen a person's health and quality of life. This concerns the process of anticipating possible difficulties in the near future, or pre-created resources for solving problems if they are unavoidable.

In order to consider the issue, we are studying as widely as possible, it was decided to adapt the definition. *The efficiency of using digital technologies in healthcare* is a large system of different indicators that significantly increase the pace of processes, efficiency and effectiveness, while significantly reducing the time for each of their individual processes. Such goals look extremely promising, and motivate to implement the rapid introduction of technologies into the healthcare system, to improve the quality of medical services, with significant optimization of time.

If we consider the medical sphere from the perspective of the consumer (population), then the most important indicator of efficiency will be the implementation of all the necessary services as much as possible. Studying the

efficiency indicator from the position of a supplier of resources and services, then profit can be considered the most important. If we take a third party, namely the economy of the state, then the most important indicator of efficiency is the GVA.

Based on the definition, it can be stated that the use of GVA in practice largely gives more opportunities in choosing the right direction for the strategic development of the healthcare system.

To evaluate digitalization, it is important to use the theory of efficiency. It is this production part of the theoretical foundation that is key in the entire production theory. In this case, the theory of efficiency is important, as only through it is realized the space for methods and hypotheses of maximum investment of assets in production.

With an increase in the capital of labor, the qualifications of employees improve, since digital innovations are impossible without obtaining new knowledge and improving professionalism. Therefore, in tandem, human resources and investments will allow for the greatest efficiency of digitalization. This frees up a person's time, which is considered as a law of saving time and one of the social effects.

The study of world experience shows that it is impossible to switch to a new model of health in the information society without creating an e-health system. In response to these challenges, the healthcare sector is being modernized at a rapid pace. Most countries develop and implement national programs, strategies and concepts in this area, achieving positive results. From this point of view, the formation of state policy and a unique methodology in the field of e-health system development in the Republic of Kazakhstan is one of the important issues.

According to the research results, countries such as Denmark and Estonia, where digital technologies have already become commonplace in practice and clinics, can be a good example of digitalization of healthcare for Kazakhstan. For example, prescriptions are transmitted digitally, and important patient health data is stored in electronic records that doctors and clinics can access directly. In Estonia and Denmark, all citizens can view the results of their examinations, medication plans or vaccination data on the Internet. They can manage the access of doctors and other medical professionals themselves.

**In the second chapter** "Analysis and evaluation of digitalization in healthcare", the current state of digitalization of healthcare in the Republic of Kazakhstan and the Karaganda region was analyzed and the socio-economic effect of digitalization of healthcare was calculated.

In Kazakhstan, by the end of 2022, medical information systems have been introduced as part of the digitalization of the healthcare industry, at the level of cities and district centers, all healthcare organizations are provided with 100% Internet access, at the level below district centers and in remote rural areas, Internet access is 86.7%.

The analysis of the digitalization of healthcare in the Republic of Kazakhstan has shown that today 49 public services are provided in various forms in the healthcare of the Republic of Kazakhstan:

- in paper form – 4 (8.2%) public services;

- in electronic/paper form – 21 (42.8%) public services;

- in electronic form – 24 (49%) of public services.

The degree of automation of the Ministry's public services is 91.8% (total - 45 automated public services).

To date, the continuation of the State Enterprise "Digital Kazakhstan" has become the national project "Technological breakthrough through digitalization, science and innovation" for 2021-2025, approved by the resolution of October 12, 2021, in which the digitalization of healthcare has become one of the tasks.

Thanks to the developed infrastructure, in 2017 the Karaganda region became a pilot region for the digitalization of healthcare in Kazakhstan. She was one of the first to introduce paperless document management. Since 2019, EPZ has been used throughout the region. According to the Department of Health of the Karaganda region, only 4,989,983 public services were provided in 12 months of 2020, of which:

- provided by service providers in paper form 866 219;

-rendered in paper form, but which could be rendered through the web portal of "electronic government" and (or) the State Corporation–465,193;

- rendered in electronic form – 3,658,571 services.

According to the result obtained in the course of our calculation, we observe the effect of the costs of digitalization of healthcare, amounting to an average of 30%. It should be noted that 30% is a relatively low efficiency indicator. But considering that healthcare is a social sphere, this result can be considered successful and considered as a positive development trend.

Further, the authors calculated the savings of conditionally fixed costs, for which data for 2016 (the period before the implementation of the state program Digital-Kazakhstan) and 2021 were used.

According to the results of our calculations, with the beginning of the introduction of digitalization of healthcare in the Republic of Kazakhstan, the savings of conditionally fixed costs at the beginning of 2022 amounted to 1.5 billion tenge. For five years of active implementation of digitalization of healthcare in the Republic, this is a good result, and in the future the effect will be even greater.

The next stage of efficiency assessment is the calculation of the social and economic effect of saving time due to the introduction of digitalization of healthcare.

According to the calculation, we received time savings in the Karaganda region in the amount of about 1353.6 million tenge, this indicator was used as a result for further calculation of efficiency. According to our methodology, the social effect was 0.61, which is a positive socio-economic indicator of the digitalization of healthcare for the population.

These are the results that were obtained three years later, after the introduction of the State Enterprise "Digital Kazakhstan" in the Karaganda region. The effect of digitalization does not manifest itself immediately, for this to happen, time must pass during which the population adapts and adapts to changing processes. According to research, the potential savings due to digital healthcare is estimated at billions.

Patient satisfaction is an important indicator of the quality of medical care, as it provides information about the success of the service provider in accordance with

customer expectations and is a key factor determining the prospective behavioral intentions of consumers.

In this regard, to determine the satisfaction of the population and medical personnel with the digitalization of healthcare, we conducted a survey in the form of a questionnaire of medical staff and the population of the Karaganda region. The survey was conducted in February-March 2021.

The author has developed two questionnaires:

1. A study of the satisfaction of employees of the medical sector with the digitalization of healthcare in the Karaganda region.

2. Study of patient satisfaction with digitalization of healthcare in the Karaganda region.

The results of the survey helped us in forming a SWOT analysis, providing data on the strengths and weaknesses of digitalization of healthcare in the Karaganda region, its opportunities and threats.

The advantages include: easier to make an appointment with a doctor, calling a doctor at home, the process of obtaining test results, accelerated the process of obtaining a patient's medical history, improved the organization of hospital preparation for the patient, facilitated the process of monitoring health indicators.

Disadvantages that exist in healthcare: queues to the doctor, a long time for filling the database with a doctor, lack of equipment, program failures, postings, low Internet speed and lack of integration between information systems.

**In the third chapter** "Increasing the efficiency of digitalization in healthcare", the author suggests mechanisms for improving the digitalization of healthcare in the Republic of Kazakhstan.

To date, priority directions of digitalization of healthcare in the Republic of Kazakhstan have been identified. The success of health strategies depends partly on the automation of certain medical procedures, such as administrative procedures and discharge practices, and on the other hand, it depends on the capabilities that health administrators have to determine the needs of the population. Additional advantages are provided by automation of certain practices, such as the transfer of referrals, medical data and prescriptions between doctors and pharmacies, hospitals and laboratories, referrals to radiologists, as well as the rationalization of resources, especially professional figures, which greatly contributes to reducing public health spending.

At the same time, the development of informatization of the healthcare industry with the involvement of the private sector and the development of public-private entrepreneurship (PPP) is relevant.

Today there are three main trends without which the digitalization of healthcare is impossible:

1. Electronic medical records, in our case an electronic health passport, the rapid dissemination of which will accelerate the integration processes of hospitals and doctors.

2. Investing in new diagnostic and therapeutic technologies that will automatically integrate patient information into the database. This includes not only new medical equipment, but also wearable gadgets.

3. Development and active use of telemedicine. Not everyone needs to consult face to face, and phone or video is an option that improves access to medical care for some citizens, especially residents of areas remote from cities. Although telemedicine cannot replace personal consultations, there are many scenarios in which telehealth consultations can be useful, convenient and safe.

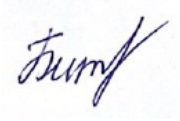
Since the benefits are not always visible, not all stakeholders are actively involved in the process of digitalization of healthcare. Undoubtedly, digital technologies make services and processes more efficient, allowing to ensure better quality and reduce the time spent, which gives many advantages for subjects of various spheres. Multilateral cooperation is important for the success of all initiatives that are being developed in the state. Innovations are based on overcoming the limitations and prospects of individual industries, rethinking traditional networks, using the strengths of each business and maximum cooperation.

Synchronous operation of the above systems is the main task of digitalization, in order to achieve the goal of improving the quality of medical care.

The main recommendations for improving the digitalization of healthcare are:

- Provide access to high-quality Internet in all corners of the country
- Create a single platform for the integration of information systems
- To introduce and actively use modern identity identification technologies
- To build a system of motivation for doctors and increase the information literacy of patients.

As follows from our study, the state should always be aware that in order to accelerate economic growth, the presence of a healthy population is a prerequisite for economic activity. The presence of a healthy population will lead to an increase in labor productivity and cause sustainable economic growth. As a result, maintaining and improving health should become one of the most important tasks in policy-making, which for today and in the future will be achievable only through effective digitalization of healthcare.

Dissertation candidate  B.S. Bitenova