MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN

SDU UNIVERSITY
SDU BUSINESS SCHOOL

«APPROVED»
Head of department
«Economics and Business»
_____ Abdrazakova A.
«05» 06 2025

PROJECT

Theme: **«The impact of fintech on healthcare payment processing»**

Specialty «7M04107 - MBA Financial Technology»

Submitted by Students
II-th course, group
«MBA Financial
Technology» _____ (signature of the student) Azamat Mankeyev

II-th course, group
«MBA Financial
Technology» _____ (signature of the student) Ainur Jaisanova

Scientific Supervisor
PhD _____ (signature of the supervisor) Assylbek Nurgabdeshov

Kaskelen, 2025

Content

Abstract 1

Chapter 1. Introduction 2

1.1 Concept and essence of financial technologies (FinTech) 2

1.2 Definition of the healthcare payment system 3

1.3 Current problems and statistics 4

1.4 Relevance of the study 5

1.5 Purpose and objectives of the study 6

1.6 Expected results and their significance for healthcare 7

Chapter 2. Literature Review 9

2.1 Theoretical Foundations of Fintech in Healthcare 9

2.2 Digital Technologies in Healthcare Institutions 13

Chapter 3. Research Methodology 19

3.1 Research Methods 19

3.2 Research Object 21

Chapter 4. Analysis 26

4.1 Assessment of the level of digitalization of a healthcare facility in Republic of Kazakhstan 26

4.2 Identification of significant factors influencing the adoption of fintech services in healthcare 32

4.3 Efficiency of digital technologies in managing the financial activities of a healthcare institution 41

4.4 Development of recommendations for the formation of management decisions as the main mechanism for financial management of a medical organization 45

4.5 Interpretation of the data obtained 53

Chapter 5. Findings & Conclusion & Recommendations 58
5.1 Main findings of the study 58
5.2 Practical recommendations 59

Conclusion 65
List of references 67
Appendices 73

List of tables

Table 1	Information systems of the Ministry of Health of Republic of Kazakhstan	24
Table 2	Number of hospital organizations, units	28
Table 3	Healthcare financing (in billion tenge)	30
Table 4	Survey results (in % of the total number of respondents)	42
Table 5	Survey results (in % of the total number of respondents, N=500) on the usability of fintech services in healthcare	43
Table 6	Survey results on the usability of fintech services in healthcare, taking into account age, regional and professional differences	44
Table 7	Survey results (in % of the total number of respondents, N=500) on trust in technology and the safety of using fintech services in healthcare	46
Table 8	Results of responses to a sociological survey among different groups of respondents	47
Table 9	Study of the degree of influence of medical workers or close environment on the use of fintech services	48
Table 10	SWOT analysis of the effectiveness of using fintech in financing healthcare costs in Kazakhstan	53
Table 11	Technical parameters of network infrastructures in IoT	55
Table 12	Analysis of the current state of financing and infrastructure	64
Table 13	Data transfer	64
Table 14	Integration with a fintech platform	65
Table 15	Implementation of digital payment services	66
Table 16	Analytical processing of accumulated data	66

Table 17 Evaluation of the effectiveness of implementing fintech and LoRaWAN 67

List of drawings

Drawing 1	General process of organizing LoRaWAN network infrastructure in design specifications	59
Drawing 2	Form definition of LoRaWAN topology	60
Drawing 3	Working platform of LoRaWAN network complex	61
Drawing 4	Process of data transmission in LoRaWAN networks	62
Drawing 5	Process of repeated request for sending data	62

List of abbreviations

The following abbreviations are used in this study:

FinTech	Financial Technologies (Financial Technologies)
USPMC	Unified System of Payment for Medical Care
MHRK	Ministry of Health of Republic of Kazakhstan
GVFMC	Guaranteed Volume of Free Medical Care
CSHI	Compulsory Social Health Insurance
HDC	Healthcare Digitalization Center
NIT	New Information Technologies
IT	Information Technologies
ICT	Information and Communication Technologies
eHealth	Electronic Health (Electronic Health)
mHealth	Mobile Health (Mobile Health)
IoT	Internet of Things (Internet of Things)
LoRaWAN	Long Range Wide Area Network (Long Range Network)
EHR	Electronic Health Records (Electronic Medical Record)
TAM	Technology Acceptance Model (Technology Acceptance Model)
BMSHK	Bureau of Medical Statistics and Healthcare of Kazakhstan
CHIF	Compulsory Health Insurance Fund
PSC	Population Service Center
STB	Second-tier banks
BIN	Business identification number

Abstract

The relevance of the study lies in the fact that financial technologies, or fintech, are becoming a key tool for transforming traditional financing methods, contributing to increased efficiency, transparency and speed of monetary transactions.

The purpose of the study is to study the impact of financial technologies (fintech) on the system of financial support and financing of healthcare, as well as to identify the factors that determine the willingness and intention of users to use fintech services within the framework of the healthcare payment system.

The object of the study is the healthcare system of Republic of Kazakhstan.

The subject of the study is the processes of applying financial technologies (FinTech) in financing and financial support of medical services.

The scientific novelty of the study lies in the comprehensive analysis of the impact of financial technologies on the processes of financing and financial support of healthcare, taking into account the specifics of digital transformation.

The paper examines the theoretical foundations of fintech and its integration into healthcare, analyzes the current state of healthcare in Kazakhstan, as well as the level of digitalization of medical institutions. Based on a sociological survey of the population, a quantitative assessment of perception, convenience, trust and social influences associated with the use of fintech services was carried out. The technology acceptance model (TAM) and regression analysis were used to process the data.

The main findings of the study show the high potential of using financial technologies in the healthcare system, especially with the support of medical workers, reliable digital infrastructure and increased financial literacy of the population. Recommendations have been developed for optimizing financing using LoRaWAN and the Unified System of Payment for Medical Care (USMP). The results obtained are of practical importance for government agencies, medical institutions and developers of digital solutions in the field of healthcare.

Chapter 1. Introduction

1.1 Concept and essence of financial technologies (FinTech)

The term “financial technologies” emerged in the early 1990s, however, interest in it and in the “fintech” sector itself from regulators, industry participants and consumers appeared after 2014 (Filippov D.I., 2018).

The term Fintech is derived from two categories - "finance" and "technology". In this regard, a number of foreign authors define Fintech as a neologism derived from two components - "financial" and "technological", which relate to the connection between modern Internet technologies and established business activity (Gomber P., Koch J. A., Siering M., 2023).

In the Oxford English Dictionary, the term "fintech" is defined more narrowly as computer programs and other technologies used to support (provide) banking and financial services (Oxford English Dictionary, 2021)

Similarly, in the Cambridge dictionary and Wikipedia, fintech is defined as "the business of using technology to provide financial services in new and better ways" (Cambridge dictionary, 2023), "financial technology" referring to firms using new technologies to compete with traditional financial methods in the provision of financial services (Wikipedia, 2025).

D.I. Filippov gives the following definition of fintech: "an industry consisting of companies using technology and innovation to compete with traditional financial institutions represented by banks and intermediaries in the banking services market" (Filippov, 2018).

Financial technologies (FinTech) are a set of innovative solutions based on the use of digital technologies to optimize, automate and improve the efficiency of financial services. FinTech covers a wide range of areas, including payment systems, lending, investments, insurance, asset management, as well as data protection and digital identification technologies.

1.2 Definition of a healthcare payment system

A healthcare payment system is a set of mechanisms, procedures, institutions and technologies that ensure financing, payment and redistribution of funds between participants in the healthcare system, including government agencies, insurance companies, medical institutions and patients (Adilet.kz, 2024).

A healthcare payment system is defined as an information system that automates the procurement of services from healthcare entities and the execution of contracts for the provision of medical services.

It covers:

- sources of financing (state budgets, health insurance funds, personal expenses of patients, etc.),

- methods of payment for medical services (direct payments, insurance, subsidies, etc.),

- models of cost reimbursement (e.g. upon service provision, upon capitation or upon treatment results),

- as well as financial flows between all participants in the system (Zolotova, Sherstyukova, 2015).

Current trends include digitalization of processes, implementation of fintech solutions, automation of payment for services and transition to patient-oriented financing models.

1.3 Current problems and statistics

In accordance with the best world practices, state policy on healthcare financing is a key task for the development of the healthcare system in any country.

According to the results of 2024, healthcare expenditures from the state budget of Kazakhstan amounted to 2.5 trillion tenge. Over the year, the indicator has remained virtually unchanged: growth is only 0.1%. As for the total volume of services, according to the National Statistics Bureau of the ASPiR RK, in the fourth quarter of last year the figure in the healthcare sector reached 1.1 billion tenge, compared to 892.7 million tenge a year earlier. In value terms, the growth was 23.2%. The volume of services in the field of general medical practice accounted for 236.6 million tenge, services in the field of specialized medical practice - 72.6 million tenge, services in the field of dentistry - 64.7 million tenge (Stat.gov.kz, 2025).

Thus, if we look at the medical care context, then thanks to the doubled funding of day hospitals, in 2023 patients were able to receive over 920 thousand inpatient-replacing services in both public and private clinics (Ncvb.kz, 2023).

The increase in funding for high-tech medical care made it possible to increase the availability of complex expensive operations for Kazakhstan by 2.5 times in 2023. Thanks to health insurance funds, patients now have access to medical rehabilitation for cardiovascular, neurological, oncological diseases and injuries, which was practically not provided before. The number of health care providers working under the compulsory medical insurance program has doubled, now there are about 2,000 of them, almost half of them are private organizations (Inbusiness.kz, 2024).

In general, the share of healthcare spending in total GDP increased from 2.8% in 2019 to 3.7% in 2022. The head of state set a goal to increase this share to 5% of GDP by 2027. In contrast, the share of out-of-pocket expenditure on health care decreased from 34% in 2018 to 31% in 2022.

In 2024, global health spending showed significant variations across countries, reflecting their economic capabilities and health priorities. According to the data, the

United States remained the leader in health spending, spending about US$14,490 per capita adjusted for purchasing power parity (PPP). Singapore also stood out with a significant increase in spending, increasing by 20.25% compared to the previous year, indicating an increased focus on health care. European countries such as Switzerland, Denmark, and the Netherlands maintained high levels of investment in health care, reflecting their commitment to providing quality health services to their people. The United Kingdom and South Korea also saw notable increases in spending, increasing by 9.76% and 9.46%, respectively. At the same time, some countries, including Brunei and Turkmenistan, saw a slight decline in health spending. Overall, these trends highlight global efforts to improve health systems and adapt to changing population needs (Gtmarket.ru, 2022).

Overall, in 2024, health financing faces multiple challenges, including declining public investment, reduced international aid, and the need to find new sources of funding to ensure sustainability and accessibility of health services for all segments of the population.

1.4 Relevance of the study

The relevance of the study is determined by a number of socio-economic and technological factors observed in the modern world. In the context of constantly growing healthcare costs, increasing burden on state budgets and increasing requirements for the availability and quality of medical services, there is an increasing need to search for innovative approaches to managing financial flows in the healthcare system. Financial technologies, or fintech, are becoming a key tool for transforming traditional financing methods, contributing to increased efficiency, transparency and speed of monetary transactions.

Integration of fintech solutions in the medical field allows not only to optimize payment and distribution processes, but also creates opportunities for individualization of financial products, such as digital insurance, micropayments,

crowdfunding for treatment and smart contracts. These technologies significantly expand access to medical financing, especially in remote or underserved regions, and also reduce costs for both healthcare providers and patients.

Amid the development of the digital economy and the growth of public confidence in digital platforms, fintech in healthcare is acquiring strategic importance. It is becoming not only a technological innovation, but also an important tool for social justice and sustainability of the healthcare system. In addition, the relevance of the topic is enhanced by the need to adapt national systems to global challenges, such as population aging, pandemics, staff shortages and limited resources. Research in this area will allow formulating scientifically based recommendations for improving the efficiency of financial support for medicine using new digital solutions, as well as identifying barriers and risks associated with the introduction of fintech in healthcare.

1.5 Purpose and objectives of the study

The purpose of the study is to study the impact of financial technologies (fintech) on the system of financial support and financing of healthcare, as well as to identify the factors that determine the willingness and intention of users to use fintech services within the framework of the healthcare payment system.

Research objectives:

1. To analyze the theoretical foundations of financial technologies and their role in the transformation of healthcare systems.

2. To define the concept of "healthcare payment system" and study its modern structure and mechanisms of operation.

3. To identify current problems of healthcare financing in Kazakhstan and the world based on statistical data.

4. Research key factors influencing users' intention to use fintech services in the healthcare system, based on the technology acceptance model (TAM).

5. Conduct an empirical study using a quantitative method (questionnaire) and analyze the obtained data using regression analysis.

6. Develop practical recommendations for integrating fintech solutions into the healthcare sector in order to increase its financial sustainability and accessibility.

1.6 Expected results and their significance for healthcare

The scientific novelty of the study lies in the comprehensive analysis of the impact of financial technologies on the processes of financing and financial support for healthcare, taking into account the specifics of the digital transformation taking place in socially significant sectors of the economy. The study also offers an empirical justification for the relationship between the perception of digital financial instruments and the effectiveness of medical payments.

The study is expected to provide a comprehensive understanding of how fintech technologies affect the financial support of healthcare and what factors determine users' readiness to accept and use them. Based on the analysis, it is expected to identify the positive impact of the implementation of fintech solutions on such aspects as transparency of financial flows, reduction of transaction costs, increased speed and convenience of payment for medical services, as well as expanded availability of health insurance and targeted financing of treatment.

Of particular importance are the results related to the identification of behavioral and technological factors that facilitate or, conversely, hinder the use of fintech services in healthcare. These data will help to more accurately identify barriers related to digital trust, digital literacy, risk perception, and technology usability.

The theoretical significance of the study is to expand the scientific understanding of the digitalization of healthcare as an economic system, where fintech acts not only as a technological tool, but also as an element of a new approach to managing financial flows. The results of the study deepen the understanding of the

role of innovative payment platforms, digital insurance, and other fintech products in the sustainable development of healthcare. In addition, the developed conceptual model of fintech service adoption factors can be used for further academic research and the development of digital transformation strategies in other sectors of the social sphere.

The practical value of the study is that it can be used as a basis for recommendations for government agencies, medical institutions, and fintech companies on the development and implementation of sustainable financial models based on digital technologies. This will help improve the efficiency of using budgetary and private resources in healthcare, create more flexible and patient-oriented payment systems, and minimize financial losses of the population when receiving medical services. Ultimately, the use of fintech can become a key element in creating a sustainable, inclusive and innovative healthcare system.

Chapter 2. Literature Review

2.1 Theoretical Foundations of Fintech in Healthcare

Today, there is no doubt that fintech has become part of the financial future, and this area will develop and transform.

Financial technologies (fintech) are a set of innovative solutions based on the use of digital tools aimed at optimizing financial transactions and increasing the availability of financial services (Sitnik, 2019).

Today, digitalization processes or any aspect of innovative technologies have a high distribution coefficient and in most cases base fundamental laws for the modernization of systems. The vector of development of life cycles is aimed at changing the coordinates, if earlier modernization systems were based on means of changing procedures within certain tasks, today we can observe how technologies have a variability effect, which in turn allows for a positive impact on the dynamic processes of the economy.

Thanks to innovative approaches that are formed by service integrators, it becomes possible to create new management processes, as well as positively influence the processes of modernization of systems. It is important to note that the digital technology industry is relevant for any life cycle that is built around the provision of services or the formation of algorithms for simplifying work. Thus, among the main foundations that should be developed through digital technologies, we can highlight the healthcare system (Cyberleninka.ru, 2021).

The healthcare sector is, first of all, a service sector. From an economic point of view, this means that most transactions are of the principal-agent type: one party pays the other party for work that must be performed under conditions of uncertainty (Ilyasova, 2019).

In the context of healthcare, fintech covers a wide range of applications, ranging from electronic payments for medical services and digital insurance to the introduction of blockchain technologies for tracking transactions and smart contracts regulating the relationship between patients, service providers and insurers.

In her work “Digitalization of the healthcare sector in Kazakhstan: main stages, problems and prospects” Z.A. Arynova identified the main prerequisites that contributed to the development of digital medicine in Kazakhstan (Arynova, 2018). The article provides an overview of all stages of digitalization development in healthcare, in particular, web-based information systems and medical information systems (MIS), which are still functioning today. The work touches upon the problems that are still relevant today, such as: the lack of unification of MIS due to a number of objective and subjective reasons, including the independent choice of medical information systems by healthcare organizations or local executive bodies, the difficulty of functioning of the electronic outpatient card or health passport due to the lack of integration of MIS with all portals of the Ministry of Health of Republic of Kazakhstan. A.A. Kim, G.K. Kurmanova, B.A. Urazova, B.B. Sukhanberdina in their work "The Impact of Digitalization of Healthcare in the West Kazakhstan Region on the Quality of Medical Services" (Kim, 2019) using the example of health indicators of the West Kazakhstan region conclude that with the introduction of digital technologies, there is an improvement in the main health indicators of the population, which, as a result, entails a decrease in financial costs in the healthcare industry. The article touches upon the topical issue of the role of the transition to an electronic health care system as a tool for feedback from the population, which, in turn, has received the opportunity to assess the quality of medical services. The article also touches upon the problems that medical organizations face when implementing digitalization. The main ones include the provision of computer equipment and the modernization of telemedicine centers.

Zh. U. Tlembaeva in the article "On the legal regulation of the use of artificial intelligence in healthcare of Republic of Kazakhstan" (Cyberleninka.ru, 2021).

touches upon such a problem as the backwardness of the legal support of artificial intelligence from technological development. The author emphasizes that legal regulation should develop taking into account the study of all the risks and specifics of the use of artificial intelligence in various spheres of life. An adequate regulatory framework should be created gradually, taking into account all the risks and specifics of the use of artificial intelligence depending on the scope of its application. When creating a regulatory framework, it is necessary not to forget about the development of new technologies in the interests of a person, the state and society. K. K. Askarov in his article "Improving business processes in the e-health system" (Cyberleninka.ru, 2021) analyzed the state of medical information systems (MIS) and their technical justification for adaptation in the automatic control system. Having analyzed five levels of digitalization of MIS, the author comes to the conclusion about the need to develop updated digital algorithms for conducting routine medical examinations. The author voiced some of the main problems of modern practical electronic healthcare: the lack of equivalence of electronic and paper document flow, duplication of documents on electronic and paper media, as well as the lack of definition of the conditions for using an electronic digital signature in the healthcare system.

E.M. Spatayev, Zh.V. Romanova, B.S. Yesenbayev in their work "Modern approaches to the formation of a national strategy for electronic healthcare" (Spataev, 2018) describe a number of changes in the healthcare system that can be implemented with the introduction of digitalization. The authors put forward the strengthening of the patient's role in relation to the protection of their own health in the first place, while information and communication technologies (ICT) are given far from the last role here. ICT should become a link between the doctor and the patient, providing the ability to constantly monitor the health of patients.

E.A. Batsina, A.N. Popsuiko, G.V. Artamonova, in their article "Digitalization of healthcare in the Russian Federation: myth or reality?" (Batsina, 2020) write that in the Russian Federation, two information platforms operate for the digitalization of internal processes of medical organizations:

- Unified State Information System in Healthcare;

- Unified Medical Information and Analytical System of Moscow.

If we compare with digital processes in Republic of Kazakhstan, it is worth noting that there are no unified medical information systems in any region of Republic of Kazakhstan. In general, the authors note that the Russian healthcare system, as well as the domestic system, uses various automated tools, such as information systems that provide direct communication between medical workers and patients.

M.N. Dudin, P.V. Golyshko, E.V. Vashalomidze, D.A. Gurtskoy, L.D. Gurtskoy in their scientific work “Development of Digital Competencies of Medical Workers in the Context of the General Digitalization of Russian Healthcare” analyze the dynamics of digitalization of Russian healthcare (Dudin, 2022).

The analysis shows that the quality and pace of digitalization of healthcare in Russia lags significantly behind similar indicators of healthcare digitalization in most OECD countries. The authors name the insufficient volume of public and private investments in digitalization as a possible problem. The authors proved the hypothesis that the further a medical organization is from the economic center (a city of regional significance), the lower the pace and the weaker the quality of their digitalization. This is due to the fact that the level of digital literacy of medical personnel in such medical organizations is relatively low.

The essence of using fintech in healthcare is to make the process of financing medical services more flexible, transparent and focused on the needs of the user. Technologies allow for prompt payment management, automation of insurance processes, implementation of personalized financial solutions and collection of large amounts of data for making strategic decisions in the field of healthcare.

In healthcare, information and computer technologies allow:

- achieving a new quality of work from a specific workplace to the industry as a whole;

- creating and implementing knowledge-intensive and resource-saving technologies;

- integrating healthcare informatization tools into a single information space of the country and global information networks.

A feature of using fintech in this area is the high social significance of medical services and the need to comply with regulatory requirements regarding the protection of personal and medical data. This determines the need for secure digital solutions that meet privacy and ethical standards. Another important feature is the diversity of consumers - from the public sector to private clinics and patients themselves - which requires flexible financial instruments and user-oriented interfaces. In addition, the use of fintech in healthcare contributes to increasing financial inclusion, providing access to medical services for low-income groups of the population through mobile payments, crowdfunding platforms and online insurance. Thus, fintech is becoming not just an element of digital transformation, but also a strategic tool for the sustainable development of the healthcare system.

2.2 Digital technologies in the activities of healthcare institutions

All computer systems in medicine and healthcare, regardless of their purpose, can be represented, according to the recommendations of Yu. Komarov, by the following levels of complexity:

Level 1 - automated data and/or information processing systems (ADPS and ASOI). They help in performing computational work, that is, they perform arithmetic operations, transforming the original data/information (payroll, accounting reports, etc.).

Level 2 - automated information and information-reference systems (AIS and AISS). They are designed to process, store and search for documents, information about documents, individual facts and information.

Level 3 - automated control systems (ACS) are associated with the

implementation of information-reference systems, with the help of which part of the information is preliminarily used in work and processed in a PC according to specified programs and then used in performing various functions, in particular, in planning and operational management in healthcare.

Level 4 - expert systems (ES) for preparing options and selecting solutions (Komarov, 2020).

The level of equipment of the healthcare system with modern information and communication technologies is extremely heterogeneous and is mainly limited to the use of several computers as autonomous automated workstations.

At the same time, the developed information systems, as a rule, are narrowly focused, oriented towards ensuring specific functions and tasks. The lack of a unified approach to their development during operation has led to the emergence of serious problems. As a result, existing information systems are a complex of disparate automated workstations, and not a single information environment.

It should also be noted here that the system must be able to work not only with quantitative, but also with difficult to formalize, specific, qualitative information, which is especially important for solving management problems in the healthcare system. According to modern concepts, an automated workplace is an automated workstation of a doctor equipped with computer technology and software packages for collecting and storing medical information used as an intelligent tool when making diagnostic and tactical (therapeutic, organizational, etc.) decisions, as noted by S. Gasparyan, they can be divided into three groups:

- AWPs of attending physicians;

- AWPs of medical workers of paramedical services (according to the profiles of diagnostic and therapeutic units);

- AWPs for administrative and economic units (Gasparyan, 2023).

AWPs are used not only at the level of primary health care - in medical and preventive institutions, but also for the automation of workplaces at the level of regional and territorial management.

In 2013, based on the Resolution of the Government of Republic of Kazakhstan dated October 10, 2013, Republican State Enterprise on the Right of Economic Management “Republican Center for Electronic Healthcare” was founded, the main goal of which is to ensure an effective healthcare system through the improvement and development of informatization and medical statistics. The Center provides services for the implementation of the state assignment “Services for the collection and processing of statistical observation data in the field of healthcare, organization of planned hospitalization, organization of the activities of Republican and regional hospitalization bureau” and “Services for the maintenance of certain software packages and electronic registers (information systems) in the field of healthcare, ensuring the operation of the national telemedicine network of Republic of Kazakhstan” (Rcez.kz, 2025).

One of the tools for providing medical services through information technology is the mobile section "E-Densaulyk" in the mobile application Egov Mobile. This section is aimed at ensuring the implementation of the right of the population of Kazakhstan to access personal medical data. The section contains 13 main blocks, which provide information about a person as a recipient of medical services, about the medical organization to which the patient is attached, about the local doctor and the citizen's insurance status. Separate blocks are data on clinical indicators and laboratory tests. The E-Densaulyk system provides information on patient diseases and services provided in medical institutions. Citizens can find information on prescribed free drugs in this application. It is planned to include a section on issuing sick leaves in electronic format. An important block in the E-Densaulyk section is information about children, their test results, and treatment. At the moment, this application is functioning in all areas. The next tool for informatization in the healthcare system is the Damumed application. This application was developed by a private company, however, despite this, it functions free of charge in Republic of Kazakhstan. A significant disadvantage of the Damumed system is that some medical organizations do not use this application, preferring other information applications.

As an advantage of the system, it can be noted that the Damumed application contains feedback, thanks to which the patient can evaluate the quality of the medical service provided to him in the application (Nur.kz, 2023).

The Damumed application has the following features: the ability to make an appointment with a local doctor for yourself and your family members; the ability to call a doctor at home; automatic application reminders about upcoming appointments with doctors; information about doctor calls made at home; formation of a database of prescriptions written out to the patient; the ability to receive a sick leave certificate in electronic format; use of a "panic button", the effect of which is the ability to urgently call a doctor to the home of people on special records; familiarization with laboratory tests in electronic format. In addition to private applications, there are health information systems of the Ministry of Health of Republic of Kazakhstan, listed in Table 1.

Table 1 - Information systems of the Ministry of Health of Republic of Kazakhstan

№	Name	Target
1	Register of attached population	Formation of a single centralized information database on the actual number of the population assigned to each healthcare organization, as well as for registration by healthcare organizations of medical certificates of birth, death/perinatal death.
2	Resource Management System	Accounting of healthcare organizations, their resources, automation of filing and review of applications for the provision of high-tech medical services.
3	Electronic register of inpatients	Automation of data collection on treated cases of inpatient and inpatient-replacing care in the volume of statistical cards of those discharged from the hospital and discharge summaries; solution of financing problems.
4	Bureau of Hospitalization	Providing participants in the process of hospitalization of planned patients in the territory of Republic of Kazakhstan with information on available beds in hospitals; on patients on the waiting list for planned hospitalization; on patients hospitalized in hospitals, or for whom a refusal of hospitalization has been registered.
5	Acute coronary syndrome registry	Registration and recording of patients with cardiovascular diseases for the purpose of further monitoring of patients.
6	Electronic registry of oncological patients	Maintaining records of patients in oncology dispensaries of Republic of Kazakhstan, maintaining and processing information on the volume of medical care provided to oncology patients.
7	Register of pregnant women and women of childbearing age	Management of groups of pregnant women and women of childbearing age to monitor their health indicators.

8	Electronic register of dispensary patients	Timely detection, continuous monitoring and rehabilitation of identified patients, as well as the formation of a single database of dispensary patients.
9	Outpatient polyclinic care	Formation of personalized data about the patient, information about his visits to outpatient and polyclinic organizations.
10	Additional component to the tariff of primary health care	Automation of calculation of the cost of points of the indicator system of primary health care organizations in the context of each region
11	System of management of drug supply, monitoring of drugs	Formation of a single database of registered and approved for medical use in Republic of Kazakhstan medicines, medical devices, medical equipment.
12	Medical Equipment Management System	Monitoring the efficiency of using medical equipment on the balance sheet of healthcare organizations.
13	Drug Provision	Issuing electronic prescriptions for free drug provision by doctors on site, provision of free drugs and medical products in pharmacy organizations.
14	Medical Services Quality Management System	Automation of the system for assessing the quality of medical services in healthcare organizations.
15	Unified Payment System	Automation of the payment process for medical care provided at the stage of primary health care and consultative and diagnostic care.
16	Vaccinations	Entering data on vaccinated patients with general information about the patient, planning the vaccination process, monitoring the patient and monitoring the two-stage vaccination process.
Note – source (Rcez.kz, 2025).		

Each information system of the Ministry of Health of Republic of Kazakhstan is aimed at solving specific problems.

Thus, the toolkit for providing healthcare services in the context of digitalization is quite extensive, including private medical information systems and systems operating under the Ministry of Health of Republic of Kazakhstan. In

addition to the advantages of using these information systems, there are also significant disadvantages that have a negative impact on the quality of medical services to patients.

In Kazakhstan, the introduction of financial technologies (fintech) in the activities of healthcare institutions is becoming an important area of digitalization aimed at increasing the efficiency and accessibility of medical services. One of the key steps in this process is the development and implementation of the Unified Digital System for Payment of Medical Services (EDSMP), which ensures the transparency of financial flows and reduces financial risks for patients and medical organizations.

Cooperation between the Ministry of Health of Kazakhstan and private companies also contributes to the development of fintech solutions in medicine. For example, joint initiatives with Freedom Finance JSC are aimed at introducing mobile diagnostic systems and developing telemedicine, which is especially important for rural regions (Gov.kz, 2024).

In addition, the country's medical institutions plan to introduce biometric identification technologies, such as Face ID, to confirm that patients have received medical services. This will improve the accuracy of accounting and prevent possible cases of fraud.

In general, the integration of fintech solutions into Kazakhstan's healthcare helps improve the quality of medical care, optimize financial processes, and expand access to medical services for the population.

Chapter 3. Research Methodology

3.1 Research Methods

This study uses a predominantly quantitative approach aimed at identifying and measuring factors influencing the intention to use fintech services in the healthcare system. Quantitative methods allow us to obtain objective, statistically valid data that can be mathematically analyzed and interpreted.

A questionnaire is used as the main method for collecting primary data. It is conducted among the target audience - users of medical services, as well as potential and actual consumers of fintech products in the healthcare sector. The questionnaire includes blocks of questions aimed at studying the perception of technologies, the level of digital literacy, trust in fintech services, as well as the willingness and frequency of their use.

The collected data is analyzed using regression analysis, which allows us to establish the degree of influence of various variables (for example, perceived usefulness, ease of use, security and trust) on the intention to use fintech services. The theoretical basis of the analysis is based on the technology acceptance model (TAM), which makes it possible to logically link behavioral attitudes with the actual actions of users (Altynbek, 2024).

Additionally, descriptive statistics are used to describe the socio-demographic characteristics of respondents and the initial processing of the results. Hypotheses are verified through methods of correlation analysis and assessment of the significance of coefficients, which ensures the reliability and validity of the conclusions.

Thus, the combination of these methods provides a comprehensive, structured

approach to studying the impact of fintech on the financial support of healthcare and allows for well-founded recommendations for its further development.

3.2 Object of the Study

The object of this study is the healthcare system of Republic of Kazakhstan, considered as a set of public and private medical organizations, financing structures, as well as mechanisms for the provision and payment of medical services. Within the framework of this study, special attention is paid to the financial aspects of the functioning of healthcare, including sources of financing, methods of resource allocation and the efficiency of their use in the context of digital transformation.

The healthcare system of Kazakhstan is a dynamically developing industry that is actively adapting to modern challenges, including the need to implement innovative solutions, digitalize processes and increase financial stability. In this context, healthcare is considered not only as a social institution, but also as an object of application of modern financial technologies aimed at increasing the availability, quality and transparency of medical services.

Table 2 - Number of hospital organizations, units

	2020	2021	2022	2023
Republic of Kazakhstan	773	773	818	872
Abai	-	-	30	35
Akmola	29	29	32	32
Aktobe	44	44	42	42
Almaty	82	82	44	44
Atyrau	29	29	32	32
West Kazakhstan	29	29	30	30
Zhambyl	47	47	52	56
Zhetysu	-	-	36	38
Karaganda	75	75	61	53
Kostanay	42	42	43	42
Kyzylorda	33	33	33	36
Mangistau	31	31	35	34
Pavlodar	36	36	38	40

North Kazakhstan	24	24	24	25
Turkestan	43	43	47	56
Ulytau	-	-	11	13
East Kazakhstan	61	61	31	30
city of Astana	37	37	32	45
city of Almaty	91	91	77	88
city of Shymkent	40	40	88	101
Note: Based on source (Stat.gov.kz, 2025).				

In the period from 2020 to 2023, the healthcare system of Republic of Kazakhstan has seen a stable positive growth trend in the number of hospital organizations. If in 2020 and 2021 the total number of hospital institutions was 773 units, then by 2022 this figure had increased to 818, and by 2023 it had reached 872. This indicates an active policy of expanding the network of medical organizations, which is especially important in the context of post-pandemic recovery and the desire to ensure more equal access to medical services throughout the country.

The growth is observed both due to an increase in the number of hospitals in existing regions and due to the inclusion of new administrative units, such as the Abay, Zhetysu and Ulytau regions, where a total of 86 institutions are operating by 2023. This indicates the implementation of institutional and territorial reforms aimed at decentralization and bringing the medical infrastructure closer to the population. It is worth noting separately that in some regions, a decrease in the number of hospital organizations has been recorded, such as in the Karaganda and East Kazakhstan regions.

This is due to the restructuring and consolidation of medical institutions, network optimization in order to improve efficiency, the introduction of multifunctional centers and the transfer of some functions to the outpatient link.

At the same time, large cities of Republic, including Astana, Almaty and Shymkent, demonstrate a significant increase in hospital institutions, especially in Shymkent, where the number of hospitals increased by more than 2.5 times from 2020 to 2023. This reflects urban growth, migration pressure and the need to meet the growing demand for medical services in megacities.

Thus, the dynamics of the number of hospital organizations in Kazakhstan over the past four years shows the focus of state policy on expanding the availability and territorial balance of medical care, as well as on modernizing the healthcare infrastructure in the context of socio-economic and demographic changes.

Table 3 - Healthcare financing (in billion tenge)

Indicator	2021 year	2022 year	2023 year	Change for the period
Total funding for the industry	1 950	2 130	2 310	+360 billion tenge
Medical rehabilitation	28	80	112	×4
Children's rehabilitation	14	22	28	+100%
Number of quotas for IVF (program "Ansagan sabi")	7 000	7 000	7 000	No change
Note: Based on source (Stat.gov.kz, 2025).				

Funding for medical rehabilitation has increased significantly compared to 2019, 7 times, including a 27% increase for pediatric rehabilitation. Since 2021, the "Ansagan Sabi" program has been implemented, providing for the annual allocation of 7,000 quotas for IVF until 2026. As a result, more than 3,000 women became pregnant, and 2,431 children were born.

According to the results of January-December 2024, healthcare expenditures from the state budget of Kazakhstan amounted to 2.5 trillion tenge. Over the year, the indicator has remained virtually unchanged: an increase of only 0.1%.

The bulk of this traditionally went to hospital services: 541.6 million tenge - 19.8% more than a year earlier. Including the services of surgical departments amounted to 86 million tenge, the services of gynecological departments and maternity hospitals - 50.7 million tenge, the services of rehabilitation centers - 31.9 million tenge, the services of psychiatric hospitals - 14.8 million tenge.

Outpatient expenses were increased, which amounted to 56% of the total. At the same time, funding for medical rehabilitation increased 13 times - from 6 billion tenge in 2019 to 78.1 billion tenge in 2024. In general, Kazakhstan continues to confidently move towards the goal of bringing the share of medical expenses to 5% of GDP by 2027.

The volume of outpatient drug provision compared to 2019 has more than doubled and amounted to 237 billion tenge, including 51.8 billion tenge for the treatment of orphan diseases. In total, 3.9 million patients were provided with drugs. A full cycle of traceable distribution of medicines to the patient (labeling, coding) has been launched in 20 medical organizations of Republic.

514 units of medical equipment worth 58.8 billion tenge have been purchased for medical institutions of Republic of Kazakhstan. The provision of medical organizations with medical equipment in 2024 increased by 2.5% compared to 2023, to 84.15% (Medservice.kz, 2024).

The number of consultative and diagnostic services provided in 2024 increased by 2.5 times and amounted to over 324 million. Expensive diagnostic services (CT / MRI) were received by 1.1 million residents this year.

The following work has been carried out as part of the development of the pharmaceutical and medical industry:

– a project for the production of syringes was implemented in the Almaty region together with the South Korean company SGP;

– The production of high- and expert-class ultrasound stationary diagnostic systems of the South Korean company Samsung Madison has been launched in Almaty;

– Hearing aid production launched in Mangistau region;

– Production of irradiators and bactericidal air recirculators launched in North Kazakhstan region;

– Production of filtering half masks launched in Shymkent;

– A line for the production of KN95 medical respirator masks with a valve has been fully prepared in Karaganda;

– Production of disposable sterile syringes with a capacity of up to 250 million units per year has been launched in Zhambyl region.

In 2024, best practice centers were opened in 48 outpatient care organizations, more than 160 specialists were trained.

A screening program for the early detection of 8 diseases (arterial hypertension, coronary heart disease, diabetes mellitus, glaucoma, breast cancer, cervical cancer, colorectal cancer, viral hepatitis) is being implemented for the adult population of Republic of Kazakhstan. The coverage of screening examinations in 2024 increased by 19.7% compared to 2023 and amounted to 8.5 million people (Gov.kz, 2024). Screening for the early detection of kidney diseases, gastrointestinal tract, respiratory organs and prostate cancer has been expanded for the rural population. In total, about 2.6 million rural residents are covered by preventive examinations. Also, more than 50 thousand residents of remote villages are covered by the services of medical trains, which is 58% more than the coverage in 2023.

In 2024, 688 thousand remote medical services were provided, which is 6.7 times more than in 2023.

As part of the implementation of the instructions of the head of state, a Comprehensive Plan for the fight against oncological diseases in Republic of Kazakhstan for 2024-2027 was approved.

The country has introduced 80 new technologies in the field of transplantology, cardiac surgery, oncology, innovative cellular technologies, and about 20 thousand people have been treated with them.

233 operations were performed at the Gamma Knife Center of the National Center for Neurosurgery in Astana, where radiosurgical treatment of diseases of the central nervous system is carried out. A total of 1,037 operations have been performed since its opening in 2021.

The Nuclear Medicine Center in Semey has conducted 776 courses of radionucleoside therapy. To meet the need for doctors, including in acutely shortage specialties, in 2024, about 6 thousand educational grants were allocated from Republican budget.

At the expense of the local budget, 16.5 thousand specialists were covered by advanced training.

In 2024, medical universities of Republic of Kazakhstan graduated about 7 thousand doctors. The graduation of mid-level medical workers amounted to more than 23 thousand people.

On October 12, 2021, the national project "Quality and Affordable Healthcare for Every Citizen "Healthy Nation" was approved, the main goal of which is to increase life expectancy (Adilet.kz, 2023).

An analysis of indicators for 2022-2024 indicates positive dynamics in the healthcare system of Kazakhstan. Increased funding, implementation of national projects and programs, as well as improved demographic indicators reflect the state's desire to improve the quality and accessibility of medical services. However, the ongoing fight against infectious diseases such as COVID-19 highlights the need to further strengthen the healthcare system and be prepared to respond to epidemiological challenges.

Chapter 4. Analysis

4.1 Assessment of the level of digitalization of a healthcare facility in Republic of Kazakhstan

As part of the digitalization of the healthcare industry, medical information systems (hereinafter referred to as MIS) have been introduced; at the level of cities and district centers, all healthcare organizations are provided with 100% access to the Internet, at the level below district centers and in remote rural areas, access to the Internet is 86.7%. Healthcare facilities with an Internet connection are constantly being equipped with IT infrastructure, data is transmitted to the Smart Data Ukimet analytical platform, and activities to integrate MIS with the Ehealth core have been planned and launched (Kap.kz, 2025).

In the Kazakhstani segment of digital mobile solutions in the field of healthcare, there are about 20 mobile applications with which the population can evaluate the work of medical organizations, leave their feedback, and choose a clinic based on criteria and reviews.

Individual software interfaces have been developed for each region, which already creates a conflict at the stage of the emergence of digital solutions.

An assessment of the level of digitalization of healthcare in Republic of Kazakhstan indicates significant progress, especially in recent years. Digital transformation of the industry has become one of the priority areas of state policy, which is expressed in the active implementation of electronic services, modernization

of information systems and digital infrastructure of medical organizations.

MedTech (technological development of the healthcare system) is one of the three priority technological areas of the Concept of digital transformation, development of the information and communication technology industry and cybersecurity for 2023 - 2029 (Adilet.kz, 2023).

Today, issues of digitalization of healthcare are also reflected in the "Concept of Healthcare Development of Republic of Kazakhstan until 2026" (Adilet.kz, 2022).

In Kazakhstan, by the end of 2024, as part of the digitalization of the healthcare industry, medical information systems were introduced, at the level of cities and district centers, all healthcare organizations are provided with 100% access to the Internet, at the level below district centers and in remote rural areas, access to the Internet is 86.7%. The analysis of healthcare digitalization in Republic of Kazakhstan showed that today 49 public services are provided in various forms in healthcare in 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%) public services.

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

Thus, the Ministry of Health of Republic of Kazakhstan has formed a single catalog of existing mobile applications in the field of healthcare on the market, which is posted on the website of Republican Center for Electronic Health of the Ministry of Health of Republic of Kazakhstan: DamuMed - making an appointment with a doctor; Dariger Pro; HealthBook; Software package for automating the dispatch center "103 CONTROL"; FMS: People's Control; HCity; My pregnancy; Egov mobile application; Oncoscreen application; Recommend a doctor.kzByMedElementCo.; Diseases: Doctor's Handbook By MedElement Co.; SOS mobile application for first aid; CDL OLYMP Kazakhstan; Komek 103; 103apteka.kz - online pharmacy; 103.kz - search for medicines; Dostarmed A.; Visiting nurse; Care of young children

(Gov.kz, 2024).

Today, thanks to modern technologies, electronic services such as registration with medical organizations providing primary health care, making an appointment with a doctor, calling a doctor to your home, etc. are provided.

One of the key achievements can be considered the creation of the Unified System of Electronic Medical Records (ESOMR), which provides storage of and access to patient data, including their medical history, tests, prescriptions and results of diagnostic procedures. This has improved the continuity and quality of medical care, reduced the number of duplicate examinations, and reduced the workload of medical personnel by automating document flow. Patients are now able to view test results, make an appointment and receive consultations through the eGov portal and the eGov Mobile application, as well as through telemedicine platforms (Leconomic.ru, 2023).

Particular attention is paid to the implementation of biometric patient identification (Face ID) in clinics, which improves data security, prevents fraud and makes citizens' interaction with the medical system more convenient. This technology has already begun to be used in pilot mode and is planned for large-scale distribution. In addition, digitalization has also affected the financial mechanisms of healthcare: through integration with the National Compulsory Social Health Insurance System (CHI), automatic registration of patients' insurance status, payment for medical services and monitoring of the quality of care provided is carried out. This has made it possible to increase the transparency of the distribution of funds and strengthen control over the targeted use of resources.

Thanks to CHI funds, health expenses per resident of the country were increased from 56 thousand tenge to 122 thousand tenge (Inform.kz, 2023).

Thus, if we look at the context of medical care, then thanks to the doubled funding of day hospitals, in 2023 patients were able to receive over 920 thousand inpatient-substituting services in both public and private clinics (Ncvb.kz, 2023).

The increase in funding for high-tech medical care made it possible to increase

the availability of complex expensive operations for Kazakhstan in 2023 by 2.5 times. Thanks to health insurance funds, patients now have access to medical rehabilitation for cardiovascular, neurological, oncological diseases and injuries, which was previously almost not provided. The number of health care providers working under the compulsory health insurance program has doubled, there are now about 2,000 of them, almost half of which are private organizations.

Overall, the share of healthcare expenditure in total GDP increased from 2.8% in 2019 to 3.7% in 2022. The head of state set a goal to increase this share to 5% of GDP by 2027. The share of out-of-pocket expenses of the population for paying for medical services, on the contrary, decreased from 34% in 2018 to 31% in 2022 (Bes.media, 2025).

At the regional level, many medical organizations are implementing information resource management systems (ERP), which cover personnel records, procurement, logistics, financial management and medical equipment. This contributes to more efficient management of institutions and decision-making based on analytics.

However, despite the progress, certain challenges remain. In a number of remote and rural settlements, the level of digitalization remains low due to insufficient infrastructure, a shortage of qualified IT specialists, as well as a weak level of digital literacy among some medical workers. Cybersecurity also requires development, especially given the growing number of digital services and the risks of personal data leakage.

In general, the level of digitalization of healthcare in Republic of Kazakhstan can be assessed as medium-high with a steady trend towards further growth. The use of fintech solutions, process automation, electronic patient records and the development of telemedicine form a modern, more accessible and effective healthcare system that brings the country closer to international eHealth standards.

In order to ensure anti-epidemiological measures for the population, the process of providing medical services remotely was launched in 2021. Remote

medical services are provided not only in the doctor/doctor mode, but also in the doctor/patient mode, which saves the time of the doctor and the patient. These services were introduced to exclude contacts of patients infected with coronavirus with the population when visiting medical organizations (Halykfinance.kz, 2024).

However, the experience of providing remote services, having demonstrated its effectiveness, has been broadcast and is currently used in servicing patients with various nosologies, since the provision of these services involves the use of not only the capabilities of the telemedicine network, but also the capabilities of other technological solutions, ranging from medical information systems of healthcare organizations to applications on mobile devices.

According to the results of 2024, the number of remote medical services provided, including telemedicine consultations to the population, is 6 million 4 thousand.

The National Telemedicine Network of Republic of Kazakhstan unites 233 healthcare facilities in the country and is subdivided into district, regional and republican levels. In 2024, regional hospitals and republican clinics conducted 21,667 telemedicine consultations (Rcez.kz, 2025).

In September 2022, Medical Avenue, together with the Samsung Medical Center, held an event to present the "Telemedicine 2022" project between medical organizations of Kazakhstan and Korea. The project is aimed at bringing the medical systems of both countries closer together, namely, collaborating in the interests of people in search of medical solutions to their health problems (Nur.kz, 2023). At the same time, at the end of 2022, the Ministry and the French company C3Médical signed a memorandum of cooperation in the field of telemedicine, teleconsultations and tele-expertise. This agreement provides for France to support Kazakhstan in developing access to healthcare infrastructure for the population, especially in rural areas (Kz.ambafrance.org, 2022).

To improve the quality of medical care, including in remote regions of the country, and ensure public health, augmented and virtual reality (AV/VR)

technologies, artificial intelligence in healthcare are being introduced. Within the framework of the Roadmap for the implementation of systems for processing, storing and transmitting medical images integrated with digital medical devices (PACS), projects are being implemented to plan the treatment of cancer patients, COVID treatment and other diseases at the expense of the local budget within the framework of a private financial initiative.

However, the existing databases (47 information systems) are fragmented and not integrated into a single information space, there is no single industry operator, which complicates the interaction of various levels and healthcare services, does not ensure the continuity of information, and limits the possibilities of operational analysis.

Within the framework of the instruction of the Head of State to improve the efficiency of the compulsory social health insurance system in the healthcare sector, the implementation of the Unified System of Payment for Medical Care (USPMC) has begun (Zakon.kz, 2025).

The new digital tool will ensure quality control and financing of the provided medical services within the framework of the GVFMC and OSHI.

In March 2025, the pilot implementation of the unified payment system began in medical organizations of the Akmola region. From July 1, 2025, the new system will be implemented in all medical organizations of the country (Tengrinews.kz, 2025). The new digital system will ensure:

- transparency of medical services provision based on personalized accounting and end-to-end control of the validity of the medical care provided;

- eliminate unjustified write-offs of funds and improve control over the quality of medical services;

- automatically identify errors and violations in the provision of medical care, including so-called "padding";

- ensure that payment for medical services is made exclusively for the care actually provided.

It should be noted that these systems are aimed at the efficient use of funds, the elimination of padding and a reduction in the share of corruption risks.

The automated system for monitoring the quality of medical services will motivate medical organizations and the healthcare system to meet the needs of patients. The effectiveness of the new system was confirmed by the preliminary results of the pilot in the Akmola region. In the pilot mode, the system has already identified more than 11 thousand cases of non-compliance of the provided medical care with the established standards, including padding.

4.2 Identifying significant factors influencing the adoption of fintech services in healthcare

Identifying significant factors influencing the adoption of fintech services in healthcare is a key stage of the study, as it allows us to determine which elements facilitate or, conversely, hinder the integration of financial technologies into the field of medical care. In the context of Republic of Kazakhstan, where the digital economy is actively developing and healthcare is being modernized, understanding these factors is especially important.

Based on theoretical models such as TAM (Technology Acceptance Model), UTAUT (Unified Theory of Acceptance and Use of Technology) and empirical data, we will highlight several key areas influencing the behavior of consumers and medical institutions regarding fintech services.

Firstly, an important factor is perceived usefulness — to what extent users believe that using fintech services, such as mobile payments, electronic insurance, automatic systems for calculating the cost of treatment, really simplifies processes, reduces the financial burden or increases the availability of medical services. If patients see a real benefit, they are much more willing to make such decisions.

Secondly, perceived ease of use is of great importance. This refers to how simple and intuitive the interfaces of fintech applications in healthcare seem to users

— mobile payment platforms, digital medical wallets, online payment and insurance services. Complex or poorly localized interfaces can reduce the level of adoption.

The third significant factor is trust in technology and security. Users must be confident that their personal and financial data is reliably protected and that transactions take place in a safe environment. This is especially important in the context of healthcare, where sensitive information circulates. Lack of cybersecurity or a negative experience with a data leak can significantly reduce trust.

The next factor is social influence and recommendations from healthcare professionals or close circle. If doctors, clinic administrators and insurance representatives actively use fintech tools and recommend them to patients, this contributes to the growth of trust and engagement. Similarly, support and promotion of such solutions by the state affects the level of their adoption.

Also, the availability of technology and digital literacy of the population play a significant role. In rural and remote regions, where the level of Internet penetration is lower and skills in working with digital services are limited, the adoption of fintech services may be difficult. This also applies to age groups, especially among the elderly.

Thus, the adoption of fintech services in healthcare in Kazakhstan depends on a set of technological, psychological, social, infrastructural and economic factors. Taking them into account allows us to form more effective strategies for the introduction of such technologies into medical practice and increase their acceptability among the population and healthcare institutions.

To identify key areas influencing the behavior of consumers and medical institutions regarding fintech services in healthcare, a sociological survey was conducted using a Google questionnaire. The survey involved 500 respondents from different regions, age and social groups.

The first block of questions in the questionnaire is devoted to determining the level of awareness and perception of the benefits of fintech services (e.g. electronic payments, online insurance, mobile applications, etc.) in the healthcare sector (Table

4).

Table 4 - Survey results (in % of the total number of respondents)

№	Question	Answer option	%
1	Are you aware of fintech services in healthcare?	Yes	68%
		No	32%
2	Have you used such services?	Yes	54%
		No	46%
3	How useful are fintech services? Main benefit (open choice)	Very useful	41%
		Rather useful	35%
		Neutral	16%
		Little useful	6%
		Not useful	2%
4	Are you aware of fintech services in healthcare? Have you used such services?	Time saving	47%
		Ease of payment	24%
		Convenient access to information	19%
		Payment security	10%
5	How useful are fintech services?	1 (low)	6%
		2	12%
		3	27%
		4	32%
		5 (high)	23%
6	Barriers to Use	Distrust of technology	28%
		Lack of necessary skills	24%
		Internet unavailability	18%
		No need	20%
		Other	10%
7	Expected Fintech Services	Online registration and payment	39%
		Transparent insurance system	28%
		Personal fintech account	18%
		Automation of social payments	15%
Note: compiled by the author based on calculations			

Most respondents are aware of fintech services in healthcare and positively assess their benefits. Such advantages as time saving and ease of payments are especially valued. At the same time, trust in fintech services is at an average and high level among more than half of respondents. The main barriers are the lack of digital skills, access to the Internet and the general level of digital literacy. Most respondents expect further development of online services for registration, payment and transparent digital reporting on insurance.

Table 5 - Survey results (in % of the total number of respondents, N=500) on the usability of fintech services in healthcare

№	Question	Answer option	%
1	How convenient is it to use fintech services in medicine? Clear interface elements Were there any difficulties with online payment?	Very convenient	36%
		Rather convenient	33%
		Neutral	18%
		Rather inconvenient	9%
		Very inconvenient	4%
2	Access devices	Buttons and navigation	41%
		Simple form of payment	34%
		Integration with mobile applications	15%
		Step-by-step instructions	10%
3	How convenient is it to use fintech services in medicine?	Yes	27%
		No	73%
4	Clear interface elements Were there any difficulties with online payment?	Smartphone	58%
		Computer / laptop	27%
		Tablet	10%
		Info kiosk in the clinic	5%
5	Access devices	Simpler interface	32%
		Support via chat	25%
		Training videos / instructions	21%
		Stable operation of the system	22%
Note: compiled by the author based on calculations			

About 70% of respondents noted the ease of using fintech services in healthcare, of which almost half called the interface intuitive. The most convenient format was via a smartphone, while computers and tablets are used less often. Only a quarter of the participants encountered difficulties when paying, which indicates a good level of perception and adaptation of technologies. To further improve convenience, citizens expect a simplified interface, more active support and accessible instructions.

Table 6 - Results of the survey on the ease of using fintech services in healthcare, taking into account age, regional and professional differences

Answer option	18-29 years	30-49 years	50+ years	Cities	Rural regions	Higher education	Secondary specialized education	Low level of education
1. How convenient is it to use fintech services in medicine?								
Very convenient	42%	31%	25%	40%	30%	38%	32%	22%
Rather convenient	30%	35%	30%	33%	32%	34%	36%	28%
Neutral	18%	20%	25%	16%	22%	18%	20%	28%

Rather inconvenient	7%	10%	12%	8%	10%	6%	6%	10%
Very inconvenient	3%	4%	8%	3%	6%	4%	6%	12%
2. Clear interface elements								
Buttons and navigation	45%	38%	35%	41%	38%	42%	40%	33%
Simple payment form	30%	36%	38%	32%	35%	34%	30%	37%
Integration with mobile applications	12%	13%	10%	15%	9%	15%	12%	10%
Step-by-step instructions	13%	13%	17%	12%	18%	9%	18%	20%
3. Were there any difficulties with online payment?								
Yes	25%	30%	30%	28%	32%	24%	27%	32%
No	75%	70%	70%	72%	68%	76%	73%	68%
4. Access devices								
Smartphone	62%	55%	45%	65%	45%	60%	55%	45%
Computer/laptop	25%	30%	35%	20%	35%	25%	28%	35%
Tablet	8%	10%	12%	9%	12%	8%	10%	10%
Infokiosk in a clinic	5%	5%	8%	6%	8%	7%	7%	10%
What can improve convenience?								
Easier interface	35%	28%	25%	32%	25%	30%	28%	20%
Chat support	28%	30%	20%	25%	35%	27%	30%	35%
Tutorial videos/instructions	18%	20%	25%	20%	20%	18%	20%	15%
Stable system operation	19%	22%	30%	23%	20%	25%	22%	30%
Note: compiled by the author based on calculations								

Young people (18-29 years) show a greater inclination to use fintech services in medicine, showing a high rating for the convenience and accessibility of the interface. Age groups 50+ have a lower level of trust and convenience in using fintech services compared to young and middle-aged people Urban residents are more active in using fintech services, especially from mobile devices, while residents of rural areas more often use laptops and computers. Rural areas also show a greater need for a simpler interface and training videos, which may indicate a lower level of digital literacy in these areas. Respondents with higher education feel more comfortable using fintech services and are less likely to encounter difficulties with online payments, which may indicate better digital preparedness. People with a low level of education express a greater need for training videos and a simpler interface, which also indicates their limited knowledge of technology.

Table 7 - Survey results (in % of the total number of respondents, N=500) on trust in technologies and the safety of using fintech services in healthcare

№	Question	Answer options	%

1	How much do you trust using fintech services to pay for medical services? How do you rate the security level of fintech services in healthcare? What security measures do you expect from fintech services?	Completely trust	19%
		Rather trust	42%
		Neutral	25%
		Rather distrust	9%
		Do not trust at all	5%
2	How important is it for you to have information about the protection of personal data? How much do you trust using fintech services to pay for medical services?	Very secure	17%
		Rather secure	39%
		Neutral	28%
		Rather unsecure	12%
		Very unsecure	4%
3	How do you rate the security level of fintech services in healthcare? What security measures do you expect from fintech services?	Data encryption	56%
		Two-factor authentication	31%
		Vendor authentication	9%
		Regular security updates	4%
4	How important is it for you to have information about the protection of personal data?	Very important	63%
		Rather important	28%
		Not very important	7%
		Not at all important	2%
5	How much do you trust using fintech services to pay for medical services?	Yes, they increase	30%
		No, they do not increase	58%
		Not sure	12%
Note: compiled by the author based on calculations			

Most respondents (61%) trust fintech services to pay for healthcare services, but there is also a significant portion that expresses doubts about security (28% rate security as neutral or low). People expect a high level of data protection, preferring encryption and two-factor authentication. Also, more than half of respondents consider the availability of information about data protection to be extremely important. Despite some concerns about cybercrime, most participants do not see this as a significant risk, indicating trust in existing security measures.

Table 8 – Results of sociological survey responses among different groups of respondents

Answer option	18-29 years	30-49 years	50+ years	Cities	Rural regions	Higher education	Secondary specialized education	Low level of education
Trust in fintech services for paying for healthcare services								
Completely trust	25%	15%	10%	18%	14%	15%	10%	12%
Rather trust	45%	40%	35%	42%	34%	40%	35%	30%
Neutral	20%	30%	30%	25%	30%	30%	35%	40%
Rather distrust	7%	10%	15%	10%	15%	8%	10%	10%

Do not trust at all	3%	5%	10%	5%	7%	5%	5%	8%
Assessing the Security of Fintech Services in Healthcare								
Very safe	18%	15%	10%	20%	14%	18%	15%	12%
Rather safe	42%	40%	35%	45%	34%	42%	35%	30%
Neutral	25%	30%	30%	25%	30%	25%	30%	35%
Rather unsafe	10%	10%	15%	5%	15%	10%	15%	18%
Very unsafe	5%	5%	10%	5%	7%	5%	5%	5%
Security measures to expect from fintech services								
Data encryption	60%	55%	45%	58%	50%	60%	50%	45%
Two-factor authentication	32%	35%	25%	30%	35%	32%	35%	30%
Vendor authentication	6%	5%	10%	6%	10%	6%	10%	18%
Regular security updates	2%	5%	12%	6%	5%	2%	5%	12%
Is there a risk of cybercrime when using fintech services in healthcare?								
Yes, they increase the risk	25%	35%	45%	20%	45%	25%	35%	40%
No, they do not	65%	55%	45%	70%	45%	65%	55%	45%
Not sure	10%	10%	10%	10%	10%	10%	10%	15%
The Importance of Privacy Information When Using Fintech Services								
Very important	58%	70%	80%	60%	60%	65%	70%	72%
Rather important	32%	25%	18%	35%	30%	30%	25%	25%
Not very important	8%	4%	2%	5%	7%	5%	4%	2%
Not important at all	2%	1%	0%	0%	3%	0%	1%	1%
Note: compiled by the author based on calculations								

Younger people (18-29 years) are more likely to trust fintech services and feel comfortable using them compared to older age groups.

Urban residents show higher levels of trust in fintech services than rural residents, indicating differences in perception of technology depending on where they live.

Respondents with higher education show more trust and expectation in using fintech services in healthcare than those with secondary education or less.

Security and data protection issues are a priority for all groups, especially for older people and rural populations.

Table 9 – Study of the degree of influence of health workers or close environment on the use of fintech services

№	Question	Answer options	% Answers
1	Does the opinion of healthcare professionals influence your use of fintech services in	Yes	63%
		No	37%

	healthcare?		
2	How often do you discuss the use of fintech services in healthcare with your loved ones?	Very often	25%
		Sometimes	40%
		Rarely	20%
		Never	15%
3	Does the opinion of healthcare professionals influence your use of fintech services in healthcare?	I will definitely use	45%
		I might use	35%
		I will hardly use	12%
		I will not use at all	8%
4	If your loved one recommends you to use a fintech service in healthcare, would you trust their advice?	Yes, I will definitely use	50%
		I might use	40%
		Unlikely	6%
		I will not use at all	4%
5	If your loved one recommends you to use a fintech service in healthcare, would you trust their advice?	Yes, I tend to trust recommendations	55%
		No, I make decisions on my own	45%
6	What role does trust in healthcare professionals play in decisions about using fintech services?	A big role	60%
		A medium role	25%
		A small role	10%
		Does not matter	5%
7	What role does trust in close circles play in the decision to use fintech services?	A big role	50%
		A medium role	35%
		A small role	10%
		Does not matter	5%
Note: compiled by the author based on calculations			

Around 63% of respondents indicated that the opinion of healthcare professionals influences their decision to use fintech services in healthcare. This confirms the importance of trust in healthcare professionals.

Respondents most often discuss the use of fintech services with their close circle (65% mentioned such discussions at least sometimes), which demonstrates the influence of social circles on decision-making.

The majority of respondents (80%) are ready to use fintech services if a healthcare professional recommends it. This confirms that medical recommendations have a significant impact on patient behavior.

A similar effect is observed for recommendations from loved ones. More than half of respondents (50%) trust the advice of loved ones, which also emphasizes the importance of social support.

For both healthcare professionals and close circles, trust plays a key role in making decisions about using fintech services. More than 60% of respondents believe that trust in healthcare professionals is crucial for making decisions about using such technologies. The results of the survey demonstrate that the perception of fintech services in healthcare in Kazakhstan significantly depends on a number of factors, among which the key ones are trust in medical workers and close circle, as well as the perception of the convenience and safety of using these technologies.

The opinion of medical workers has a significant impact on the decision to use fintech services. 63% of respondents confirmed that a doctor's recommendation significantly increases their willingness to use such services. This confirms the importance of trust in specialists and their influence on patient behavior in matters of using technologies in healthcare.

Another important factor is the opinion of loved ones. 50% of respondents are ready to trust the recommendations of family and friends when deciding to use fintech services in medicine. This indicates the importance of social connections and the influence of personal contacts on the perception of new technologies.

69% of respondents believe that the convenience of the interface and ease of use of fintech services play a key role in making a decision to use them. A simple and intuitive interface significantly increases the attractiveness of such services for users, especially for people with low levels of digital skills.

Problems with online payments and access to the necessary devices also affect the perception of fintech services. Despite this, 73% of respondents said they did not encounter difficulties with online payments, indicating a high level of willingness to use such technologies.

About 57% of respondents believe that chat support and training materials can significantly improve the use of fintech services, especially for less experienced users. This indicates a need for additional educational and technical support to increase the availability and trust of such services.

Thus, the adoption of fintech services in healthcare in Kazakhstan is influenced

by a combination of social, psychological and technical factors. Trust in health workers and loved ones, as well as the convenience and ease of use of technology, are the main drivers of fintech service adoption. At the same time, to increase their attractiveness and accessibility, it is necessary to continue working on improving the user experience, as well as providing support and training to different groups of the population.

4.3 Efficiency of digital technologies in financial management of healthcare institutions

In modern conditions in Kazakhstan, the health of each person as a component of the health of the entire population becomes a factor determining not only the full value of his existence, but also the potential of his capabilities. The level of health of the people, in turn, determines the measure of socio-economic development of the country. Therefore, state support in the field of healthcare financing includes the provision of accessible and high-quality medical care to the entire population of Republic of Kazakhstan.

Since January 1, 2020, a new model of the guaranteed volume of medical care and a package of the compulsory medical insurance system have been introduced, providing for the leveling of the risks of inaccessibility of basic medical services to uninsured persons, lists of medical care within the framework of the new model of the guaranteed volume of medical care and in the compulsory medical insurance system have been approved (Uchet.kz, 2020).

As part of the development of the compulsory medical insurance system, the Social Health Insurance Fund (hereinafter referred to as the SFHI) was created with 17 regional branches. However, the tools for assessing the quality of medical care indicators of health care providers have not been implemented in order to improve the efficiency of the SFHI (Egov.kz, 2025).

As of January 1, 2022, 81.3% or 15.5 million of Kazakhstan's population are

participants in health insurance. In 2021, 751.4 billion tenge were received in the form of contributions and deductions for compulsory medical insurance, of which state contributions for beneficiaries amounted to 46% of all receipts, or 346.5 billion tenge. Thus, the state continues to maintain its social obligations to the population. Employers' contributions for their employees in total amounted to 195.4 billion tenge (30%), employee contributions - 178.7 billion tenge (23.8%). The share of contributions from individual entrepreneurs, payers of the Unified Social Tax, independent payers working under civil-law contracts amounted to about 4% (1cbit.kz, 2022). At the same time, more than 3 million Kazakhstan remain outside the compulsory medical insurance system. The main problems of implementing the compulsory health insurance system are the identification and updating of the self-employed population, the inaccessibility of medical care in the compulsory health insurance system for the unemployed who are not registered with employment centers, as well as the loss of hired workers from the compulsory health insurance system (sent on leave without pay, laid off, etc.).

In order to increase the coverage of the population in the compulsory health insurance system, as well as the availability of medical care in the compulsory health insurance system, an alternative mechanism for joining the compulsory health insurance system in the form of paying contributions for 12 months in advance has been established by law. It is expected that about 30% of the uninsured population will use this mechanism, and accordingly, they will have access to medical care in the compulsory health insurance system.

Under the compulsory health insurance system, more than 620 thousand patients were treated on a planned basis in hospitals, 558 thousand operations were performed. About 170 billion tenge were allocated for this in the compulsory health insurance system, which is 58% of the total funding for specialized medical care in inpatient settings. As a result, the number of patients waiting for planned hospitalization for 10 days or more decreased by 13% (from 21.1 thousand to 18.5 thousand patients).

The compulsory medical insurance system allowed to significantly increase drug provision at the outpatient level, expand the list of free drugs for patients from 45 to 128 diseases, expensive studies (CT, MRI, PET) became available to all citizens of the country for medical reasons (until 2020, only to socially vulnerable 8 categories of the population), high-tech operations increased 3-fold since 2019, and medical rehabilitation began to develop.

Medical care within the framework of the guaranteed volume of medical care and compulsory medical insurance is provided by 4,060 healthcare entities, of which 1,689 (41.6%) are state-owned and 2,371 (58.4%) are privately owned (Gov.kz., 2024).

For the period 2018-2019. There is an annual increase in total healthcare expenditure in absolute terms, but the share of total expenditure in GDP is decreasing (from 3.1% of GDP to 3.0% of GDP). In 2019, in OECD countries, the share of public expenditure in the structure of current healthcare expenditure was 73.5%, which is 20% higher than in Kazakhstan (60%). In the structure of current healthcare expenditure in 2019, 60% is accounted for by public expenditure, 40% by private expenditure of the population.

The COVID-19 pandemic has forced us to reconsider not only healthcare policy, but also financing. According to national health accounts, in 2020, total healthcare expenditure increased to 4.0% of GDP (2,828.9 billion tenge), including current expenditure - 3.8% of GDP (2,676.8 billion tenge) and capital expenditure - 0.2% of GDP (152.1 billion tenge). In OECD countries, the average share of current expenditure is 9.7%, which is 2.55 times higher than the share of current healthcare expenditure in Kazakhstan.

In the structure of current healthcare expenditure in 2020, 66.2% is accounted for by public expenditure, 33.8% by private expenditure of the population. According to the recommendations of the OECD and WHO, in order to achieve universal health coverage and increase the sustainability of the health system, the share of private expenditure should not exceed 20% of current healthcare

expenditure, which shows the need to increase the share of public expenditure in the structure of current healthcare expenditure, including through the compulsory health insurance system.

Table 10 - SWOT analysis of the effectiveness of using fintech in financing healthcare costs in Kazakhstan

Strengths	Weaknesses
- Increased transparency of financial flows in the healthcare system thanks to digital platforms and blockchain solutions. - Acceleration of settlements between patients, medical institutions and the state. - Reduction of administrative costs due to automation of processes. - Ability to track and analyze expenses in real time. - Expanding access to financing through integration with government services (e.g. eGov, DAMUMED, ASHYQ).	- Low level of digital literacy among some medical personnel and the population. - Limited access to the Internet and digital devices in rural and remote regions. - Insufficient level of trust in digital payment systems and fintech platforms. - Imperfect legal framework for regulating fintech services in healthcare. - Dependence on the stability of IT infrastructure and cybersecurity.
Opportunities	Threats
- Implementation of intelligent healthcare financial management systems (based on AI and Big Data). - Expansion of telemedicine and integration with fintech platforms for direct payments. - Partnership with private fintech companies to develop digital medical wallets and microinsurance. - Development of mobile applications for self-monitoring and payment for medical services. - Increasing the transparency of the compulsory medical insurance system through fintech integration.	- Risk of leakage of personal data and medical information. - Potential failures in systems leading to delays in payments and funding. - Growing digital inequality between urban and rural populations. - Resistance from traditional medical institutions and administrators. - Geopolitical or economic crises limiting the development of digital solutions.
Note: compiled by the author based on the source (Vasilenko, 2019)	

SWOT analysis shows that fintech solutions have high potential to improve the efficiency of financing the healthcare system in Kazakhstan. However, to achieve this potential in a sustainable manner, it is necessary to eliminate the digital divide, increase public confidence in technology, ensure cybersecurity, and improve the regulatory framework. If implemented correctly, fintech can become a key tool for optimizing and modernizing the financial support for healthcare in the country.

The main problems of the healthcare financing system are:

– high level of private healthcare expenditure;

– incomplete population involvement and unavailability of medical services of the compulsory medical insurance package for the uninsured part of the population;

– insufficient use of tools for assessing the quality of care indicators of healthcare providers.

4.4 Development of recommendations for the formation of management decisions as the main mechanism for financial management of a medical organization

The growth of digital devices based on the general specifications of the Internet of Things is increasing annually. In addition, following the increase in digital solutions, the technological environment of telecommunication channels is increasing, which, due to expanded technologization, facilitate the connection of various types of digital systems and devices. With the development of the Internet of Things platform in the healthcare structure, an increase in wearable devices and remote control systems is expected, which will improve management processes (Vc.ru, 2020).

According to research data, today the classification of the Internet of Things includes four network complexes that can be used for digital optimization of healthcare systems. Telecommunication systems allow expanding the rules of communication and forming machine-to-machine communications between objects and items, thus increasing the range of possibilities in the healthcare structure. As a detailing of complex data transmission systems, all types of telecommunication platforms that can be used for digitalization of the healthcare sector were studied in the study. As an example, comparative results of network technologies were presented in the table.

Table 11 - Technical parameters of network infrastructures in the IoT

Specifications	5G/IMT-2020	SigFox	EoRaWAN	NB-IoT
Frequency	60 GHz	868,915 and 433 MHz	868,915 and 433 MHz	900 MHz, 1.8-2.7 GHz

Range	2 km	2-10 km in the city	7-20 km	10-15 km
Distance	Up to 10 Gbps	100 bps	0.25-5.5	150-250
Data Transfer Rate	AES, SNOW	AES with HMACs	kbps	kbps
Security	10 OOx nodes	50,000 nodes	64/128-AES	128/256-
Note: compiled from source (Vc.ru, 2020).				

Using the Internet of Things infrastructure in the processes of optimizing the working interfaces of healthcare systems, it is possible to form a collaboration of information environments that will comprehensively affect the processes of optimizing medical institutions. In this case, two ranges of technological solutions can be distinguished: the organization of individual medical gateways and the formation of independent sensors that will measure the vital signs of patients remotely and conduct continuous registration and analytical assessment of the indicators. Therefore, the network specifications presented in the table are classified according to technological regulations, since safety, energy efficiency and correctness in reading data are the main requirements of medical institutions. Using the Internet of Things infrastructure in the structure of healthcare, it is possible to classify several types of working algorithms that will be acceptable for medical services.

In both cases, to improve quality, it is necessary to use independent digital systems that will be installed individually on the human body for fixation. In this case, the working algorithms formed between devices will depend on the telecommunication environment. Thanks to the use of innovative systems in the processes of modernization of medical service structures, it is possible to radically change the quality of services provided and systematically build logical procedures for the formation of full-scale telemedicine in Republic of Kazakhstan. The process of telemedicine development in Republic of Kazakhstan began in 2015, for seven years of advances only some solutions have been put forward that are regulated by software implementation.

The basics of telemedicine assume the use of innovative systems that will simplify or, in some cases, modernize the environment for providing medical services. The specification of medical institution optimization systems considered in the study is based on the studied problems and, based on the identified problems, the main formal IoT systems are determined, which can form the main process of digital optimization of actions. To conduct in-depth research, a specific model of technological tasks is required, based on which it is possible to build a full-fledged technological map that determines the process of modernization of healthcare systems.

The process of organizing electronic healthcare systems should begin with identifying the needs of health workers and patients. This approach will allow us to build positions on the formation of an electronic platform in medicine in the coordinate plane. A functionally new solution is the organization of information systems that will be present as additional algorithms to improve the quality of processes. Within the framework of a single standard defining the order of organization of e-health systems, the fundamental principles of centralization of medical services have been adjusted. Using new IoT rules, digitalization processes will be present that can be implemented by foreign experts in the field of engineering. The Ministry of Health supports all initiatives for the development of digital solutions in medical institutions and in every possible way accompanies the organization of new financial projects. The main repository, according to the presented example, is e-health, this is a kind of bus that branches digitalization processes into different segments and at the same time serves as a centralized body that forms the integration process.

Organization of e-health processes will require expansion of functional positions not only at the level of hardware implementation, but also at the level of the information environment, in total all algorithms will be able to develop application processes. Today, at the initial stage of development, e-health systems are developed according to two principles, applications and information environment. Information

systems are built within the framework of the technological environment as a client-server, but in this case it is important to understand that in order to expand the functional environment in medical institutions it is necessary to organize server centers for storing and processing information. With an increase in the number of digital devices in the system, stationary data centers of telecom operators located on the territory of the country will be connected. Today, in Kazakhstan, the development of cloud systems is just beginning, so this process requires careful elaboration of tasks. But if the implementation of cloud computing systems is carried out in the structure of healthcare, then high indicators can be achieved. In the process of analysis, a working specification of e-health systems was modeled, which displays the entire range of technological and functional implementation of systems, as an example, the main working algorithms for the implementation of the system are built in the figure (Digitalbusiness.kz, 2024).

Thus, it is important to break down the optimization process into structural links in order to understand the entire spectrum of algorithmic optimization systems. Everything related to healthcare structures can be classified by competent medical specialists who express high needs for digitalization of a large number of work processes. And at the same time, the structural algorithms of digital systems are within the competence of highly qualified specialists who evaluate the engineering aspects of each innovative system. Consequently, all processes for organizing electronic healthcare are considered related, since only thanks to two competent bodies, it is possible to correctly organize digital management systems.

Having studied the spectral indicators of telecommunication systems and engineering specifications of digital devices, the work was based on the LoRaWAN network as the main infrastructure in the framework of modernization of forms of healthcare system management. A set of comparative analyses was carried out in the work, within the framework of which communication networks were determined that can be used for projects to optimize healthcare systems. In terms of its technological nature, the LoRaWAN network has a large number of privileges and is fully suitable

for the healthcare structure, since the data exchange environment will be activated in the work process, LoRaWAN perfectly copes with the task of such a scale. Thus, to regulate the topology of building LoRaWAN networks, the figure shows a general scheme of the technological specification.

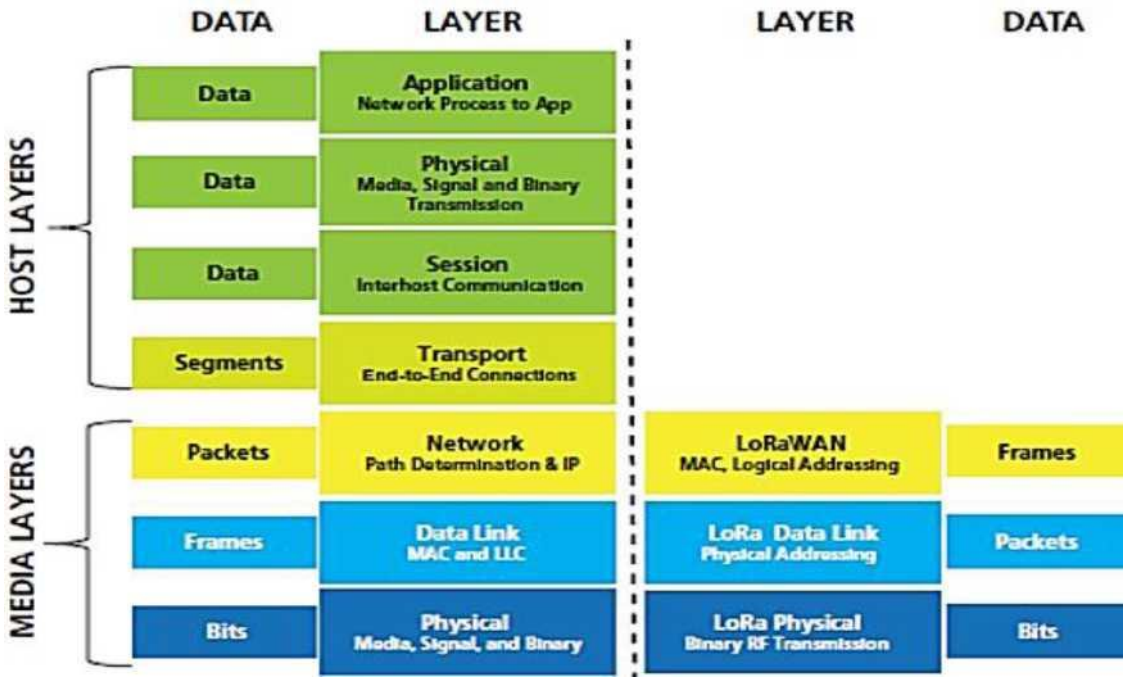

Figure 1- General process of organizing the LoRaWAN network infrastructure in design specifications (Univ-smb.fr, 2022)

For more details, it is important to note that the LoRaWAN network is planned to be used in medical institutions in order to improve the quality of service and reduce the time resources for analyzing physiological data. In foreign countries, it is common practice to organize inter-machine communications within medical institutions, which are aimed at maintaining the operation of digital devices that are privately installed on the human body as prescribed by a doctor. This type of solution gained particular popularity at the beginning of the pandemic, and due to the positive result, the experience is being broadcast to all European countries. Based on the experience of foreign countries, it is planned to organize similar systems for optimizing medical institutions, which will allow us to rebuild working algorithms for monitoring patient health (Univ-smb.fr, 2022).

Thus, before designing digitalization forms, the analysis process focused on

regulating the basic engineering specifications of the LoRaWAN network infrastructure. First of all, it is important to understand that the LoRaWAN network is one of the leading network infrastructures that can be used in a set of Internet of Things solutions. The working specification of the LoRaWAN network is formed by the platform environment for distributing work positions, which are regulated by the general classification of systems. The network in question is in demand due to its technological independence, which, despite external factors, can operate for seven years and form a large signal range. It should be noted that the listed indicators are characteristic only of LoRaWAN networks, which distinguishes the network within the entire telecommunications specification. As an example, Figure 2 shows generalized segments of the LoRaWAN network topology, according to the standard.

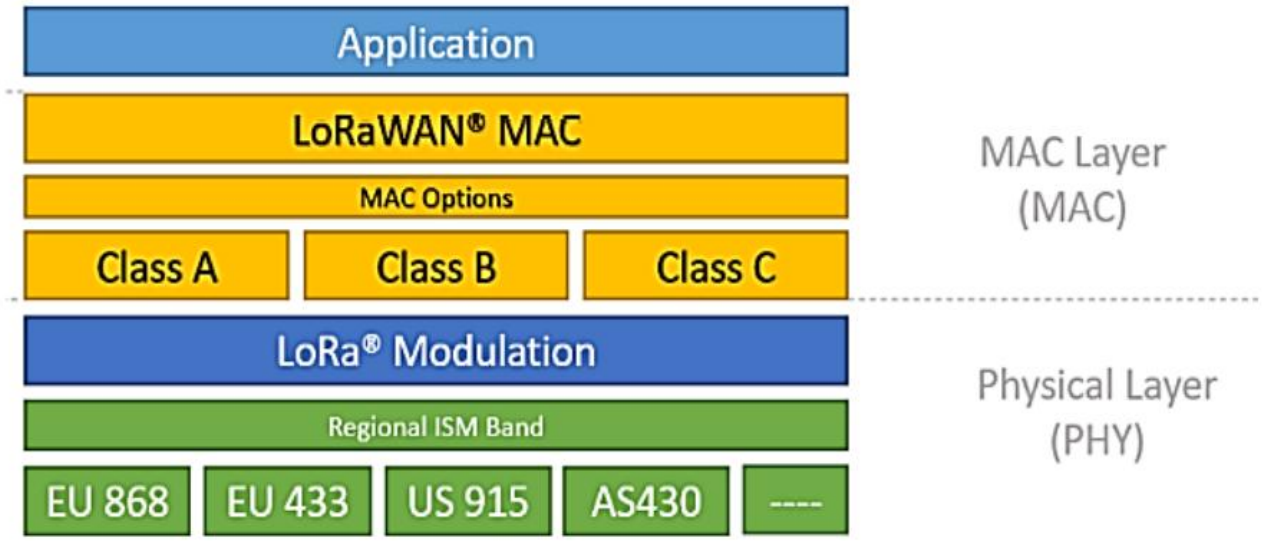

Figure 2 - Formal definition of LoRaWAN topology (Univ-smb.fr, 2022)

The development of LoRaWAN networks in the domestic market is supported by telecom operators such as Astel, Kazakhtelecom and Beeline, who, assessing the great opportunities, are actively developing networks of this level. For the development of the LoRaWAN network in Republic of Kazakhstan, frequency standards have been approved that allow digital devices to operate that can only operate at our frequencies and that have undergone thorough testing. In the process of

analyzing the technical specifications of LoRaWAN networks, materials from domestic companies that are engaged in the development of digital complexes in the country were used. For example, Figure 3 shows a working cluster of systems that defines the general format for the implementation of LoRaWAN systems.

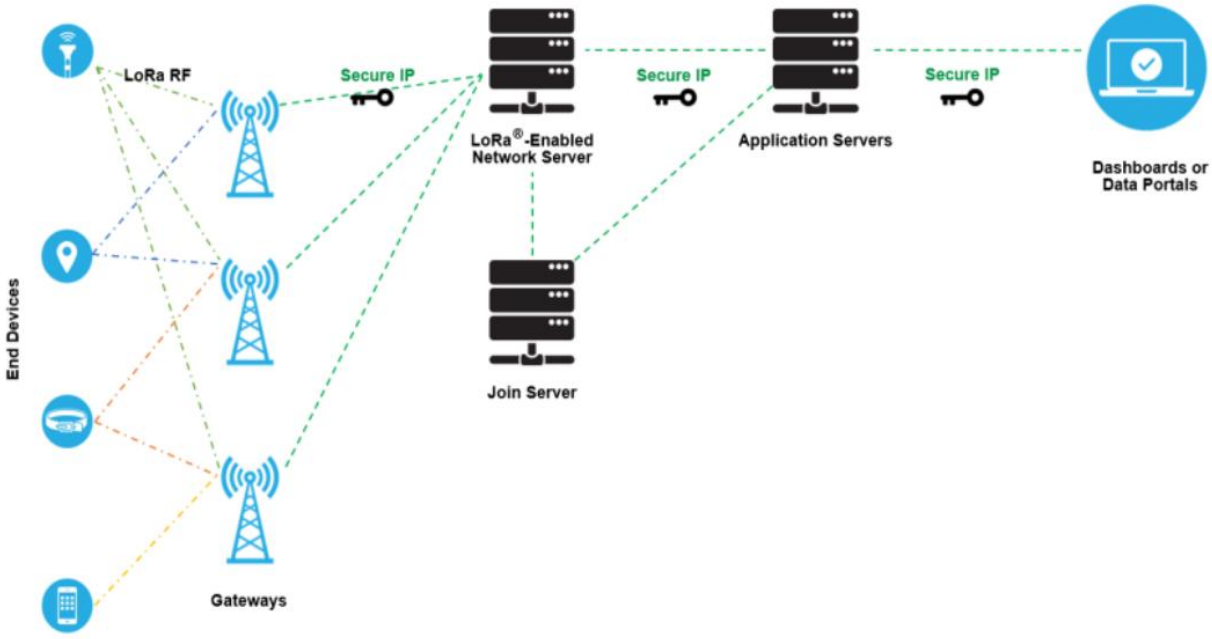

Figure 3 - Working platform of the LoRaWAN network complex (Univ-smb.fr, 2022)

Each device registered in the system can operate in the RK within the ranges of 865-868 MHz, which classifies the individual spectrum for the use of innovative solutions and systems. Devices can be both portable and stationary, the main condition is the organization of work processes in the signal coverage area, this is the only way to correctly build the work process.

A digital device is connected to a base station, which is defined at the software level as being close to the user. In this case, the analogy of the operation of digital LoRaWAN devices can be associated with the operation of mobile terminals, which, being in the coverage area of a stable signal, can be serviced. The LoRaWAN network, in its technological image, forms data packets and transmits them over long distances. The data packet is information collected by the end device, which is

installed to register the necessary indicators (Thethingsnetwork.org, 2023).

At the time of data transmission, the device connects to the central gateway and transmits a signal that it is ready to share data, the gateway, receiving the signal, gives permission to send data. As an example, the figures show working specifications of information transmission processes in LoRaWAN networks.

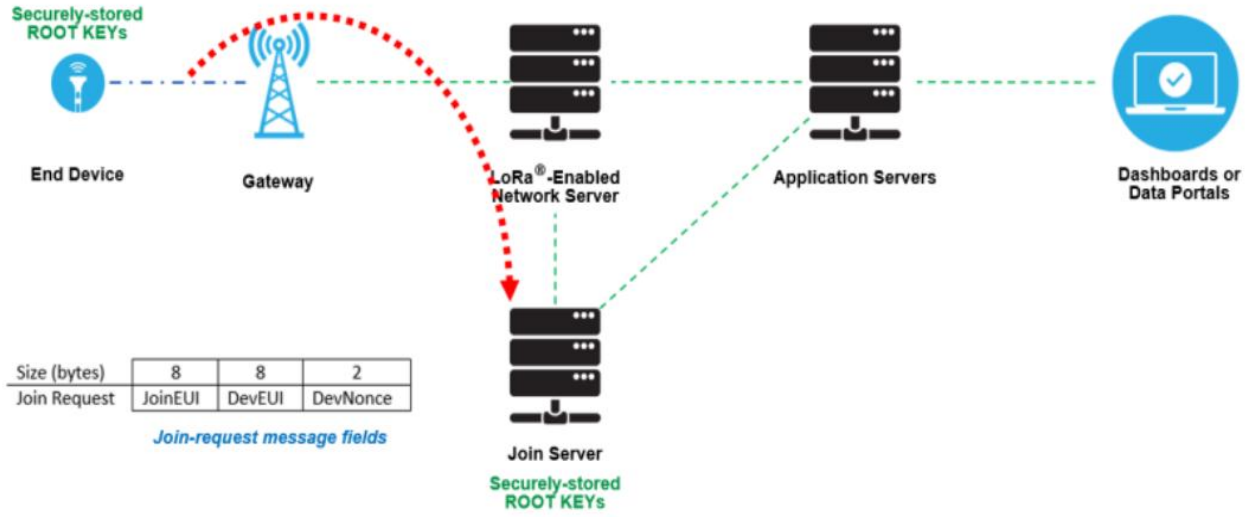

Figure 4 - Data transmission process in LoRaWAN networks (Univ-smb.fr, 2022).

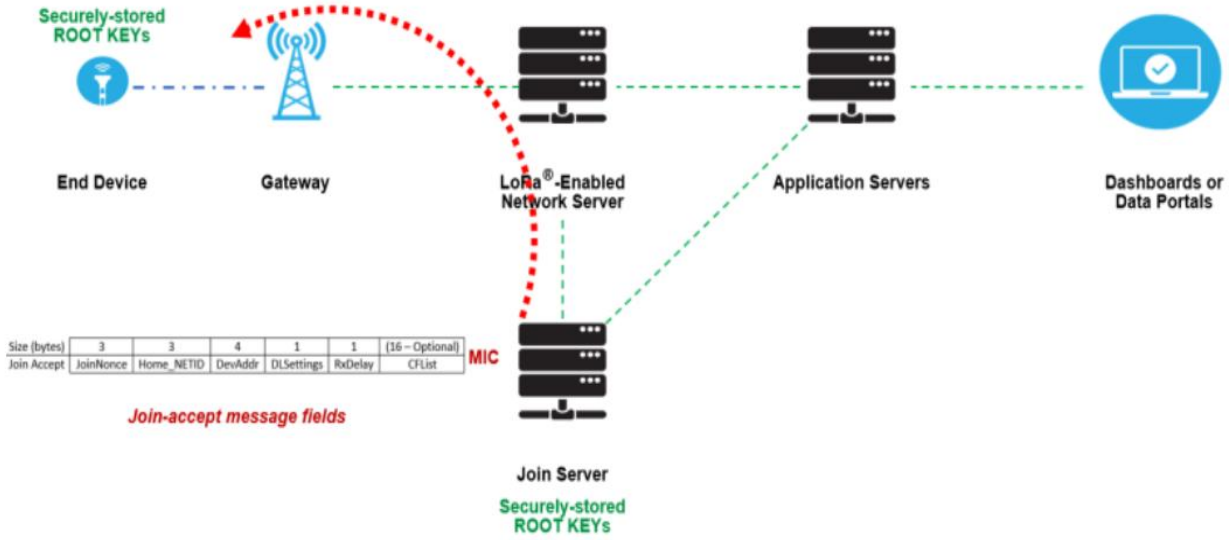

Figure 5 - The process of repeated request for sending data (Univ-smb.fr, 2022)

Technically, the LoRaWAN network can operate in three classification modes,

which determine the time indicators for transmitting information between organized digital complexes. In general, the LoRaWAN network can be configured for temporary data transmission, this means that the device installed on the patient will transmit data only at a specified time. In addition, LoRaWAN devices can transmit information as data accumulates, in this case, the process occurs when changes are registered on the patient's body using a digital device, data is transmitted. The third mode classifies the operation of the digital device on a permanent basis, which allows you to work with an interval of one minute. It is important to understand that data transmission requires battery life to maintain working algorithms and frequent communication of the digital device can lead to a violation of the energy efficiency of all systems (Thethingsnetwork.org, 2023).

The LoRaWAN network has a technologically effective environment that allows you to build comprehensive automation solutions, taking into account the possibility of organizing new digital infrastructures or adapting to existing systems. This functional feature will allow for many changes and optimizations of external and internal systems. Therefore, the LoRaWAN network selected in the analysis for organizing electronic healthcare is one of the right solutions for fully improving the performance of systems.

4.5 Interpretation of the obtained data

In modern conditions, Kazakhstan's healthcare system is faced with the need to optimize financial flows, ensure transparency in the use of budget funds and increase the availability of medical services. The use of fintech solutions in combination with LoRaWAN, a data transmission technology for IoT devices, can radically change the processes of accounting, payment and monitoring.

At the first stage, "Analysis of the current state of financing and infrastructure", an audit of the existing financing system is carried out. Key problems are identified: inefficient budget allocation, payment delays, lack of transparent accounting of

resource consumption, manual collection of reports.

Table 12 - Analysis of the current state of financing and infrastructure

Analysis indicators	Problems identified in pilot regions
Time of payment for services	up to 30 days delay
Share of reports provided in manual format	78%
Integration with mobile services	less than 20% of institutions
Control over actual resource consumption	absent in most medical institutions
31. Note: compiled by the author based on the source (Diveeva, 2023)	

Based on the audit results, the implementation goals and architecture are developed.

The next step "Deployment of an IoT system based on LoRaWAN in medical institutions" is the implementation of the LoRaWAN infrastructure for real-time data collection. Sensors are installed at key points: medical equipment, drug warehouses, water and power supply systems. LoRaWAN allows data to be transmitted with minimal energy consumption even from remote areas.

Table 13 - Data transmission

Sensor type	Purpose	Data transmission frequency	Protocol
Temperature and humidity	Monitoring of storage conditions of drugs	1 time per 15 minutes	LoRaWAN
Water and energy meters	Accounting of utility resources	1 time per hour	LoRaWAN
Equipment tracking	Control over use and location	in real time	LoRaWAN+GPS
Note: compiled by the author based on the source (Thethingsnetwork.org, 2023).			

All data is sent to the server and then to the fintech platform analytics.

After the deployment of the IoT infrastructure, integration with the fintech platform occurs. Integration with the fintech accounting and financing platform allows you to automate financing processes - from submitting an application to transferring funds.

The fintech platform implements:

- online accounting of actual costs (via sensors and API);

- smart contracts for payment for services rendered;
- instant transfers via digital wallets;
- forecasting future costs using machine learning.

Table 14 - Integration with the fintech platform

Financial processes	Before implementation	After implementation
Application approval time	12–15 days	2-3 days
Payment	20 days	within 1 day
Assessment of resource consumption	Once a month manually	Real time
Reporting to the Ministry of Health and the Treasury	Manually, monthly	Automatically, daily
Note - compiled by the author		

At the stage of "Implementation of digital payment and reporting services for patients", external users are connected - patients. Through fintech applications and eGov portals, they get access to:

- history of visits and services rendered;
- payment via QR codes and Kaspi/Mobile Wallet;
- notifications about the status of treatment and payments;
- assessment of the quality of services.

Payments are automatically sent to the accounting system, which reduces the burden on the accounting department and ensures transparency.

Table 15 - Implementation of digital payment services

Digital function	Tool	User benefit
Online payment	Kaspi QR, HalykPay, eGov	Cashless, instant payments
Notifications	SMS, Telegram bot	Information about accounts, receipt of funds
Feedback about the service	Mobile application	Feedback and rating of doctors
Note - compiled by the author		

After the platform stabilizes, analytical processing of the accumulated data

begins. Machine learning is used to:

- identify peak loads;
- optimize the schedule and resources;
- provide early warning of budget overruns;
- assess the effectiveness of purchases and investments.

Table 16 - Analytical processing of accumulated data

Metric	Before implementation	After implementation
Cost forecast accuracy	±25%	±5–8%
Analytics coverage	Only large institutions	All, including rural
Budget allocation efficiency	Does not take seasonality into account	Model planning
Note - compiled by the author		

At the final stage, the project is being scaled up to all regions of Kazakhstan. LoRaWAN gateways are being installed in new medical organizations, the system is being integrated with regional and central databases. A monitoring center with round-the-clock access to analytics is also being created.

Feedback from users — patients, administrators, doctors — is used to improve the interface and automation logic.

Table 17 – Evaluation of the effectiveness of fintech and LoRaWAN implementation

Category	Before implementation	After implementation
Funding Transparency	Low	High
Resource Control	Manual and limited	Automatic and full
Patient Engagement	Limited	Increased through fintech applications
Financial Losses	Up to 15% of budget	Reduced to <5%
Reporting Speed	Up to 30 days	Daily online
Note - compiled by the author		

The introduction of financial technologies in combination with the LoRaWAN network in the process of financing medical institutions of Republic of Kazakhstan forms a fundamentally new approach to resource management in healthcare. The effect of the proposed recommendations is that the digitalization of all links of financing makes the system transparent, predictable and manageable in real time. The

use of LoRaWAN allows you to receive reliable and continuous data from medical equipment, warehouses and infrastructure nodes, which eliminates the subjective factor in planning and spending funds. Fintech solutions, in turn, provide instant calculations and automation of documentation, which minimizes losses, corruption risks and increases public confidence.

The expected result is a sustainable reduction in operating and transaction costs, an increase in the quality and availability of medical services even in remote regions, more accurate budgeting and an even distribution of resources between institutions. In addition, the active involvement of patients in the system of digital payments and control over the provision of services contributes to the formation of a new model of interaction between the state, a medical institution and a citizen, based on trust, transparency and joint responsibility for health.

Chapter 5. Findings, conclusion and recommendations

5.1 Main findings of the study

Digitalization in healthcare of Republic of Kazakhstan is one of the priority areas of state policy. The relevance of this issue is associated with the ever-growing need for high-quality provision of medical services and their availability. The main goal of digitalization in the healthcare system is the introduction of electronic document management, thereby completely eliminating paper document flow. Digitalization in healthcare contributes to the formation of a complete database of patients, medical organizations and types of services provided that are available not only to employees of medical institutions, but also to patients.

The development of digitalization in the healthcare sector is included as one of the areas in the State Program for the Development of Healthcare of Republic of Kazakhstan for 2020-2025, which specifies a set of measures and funding for the implementation of this program.

Currently, medical information systems are being actively introduced in Kazakhstan. The first group of MIS is under the jurisdiction of the Ministry of Health of Republic of Kazakhstan. The second group is private developments. In addition, a number of electronic and mobile applications are operating.

The main findings of the study on the impact of financial technologies (fintech) on the financing and financial support of healthcare in Republic of Kazakhstan

suggest that the integration of digital solutions into the healthcare industry opens up significant prospects for improving the efficiency, transparency and sustainability of the medical system.

First of all, the analysis showed that the level of digitalization of healthcare in Kazakhstan continues to grow, but its potential in the field of financial management of medical institutions has been realized only partially. The use of fintech solutions, such as electronic payment systems, automated platforms for accounting and reporting, mobile applications for payment and control of medical services, are already demonstrating a positive impact on reducing costs, increasing the speed of processing financial transactions and convenience for the end user - the patient.

The results of sociological surveys revealed that the population as a whole has a positive perception of fintech services in healthcare, especially in terms of convenience and transparency of payment. However, the adoption of such technologies is significantly affected by the level of trust in security systems, recommendations of health workers, as well as the age and digital literacy of patients. This indicates the need for targeted information campaigns and digital training among various groups of the population.

The statistical and regional differences in access to digital financial services revealed highlight the importance of addressing infrastructure and organizational challenges, including the development of data networks such as LoRaWAN in remote and rural areas. In addition, the effectiveness assessment showed that the combination of fintech and IoT technologies allows healthcare institutions to more accurately plan budgets, control resource use, and provide feedback to patients. Thus, the study confirmed that fintech can become the most important tool for transforming the financial model of healthcare in Kazakhstan. To do this, it is necessary to ensure systemic support at the state level, involve all stakeholders in the development of standards and regulations, and invest in digital infrastructure and personnel training. Only with an integrated approach can we achieve a sustainable increase in the availability and quality of medical services, while simultaneously optimizing their

financing.

5.2 Practical recommendations

The implementation of the Unified System of Payment for Medical Care (USMP) has begun in Kazakhstan. The implementation of the USMP was launched as part of the instruction of the head of state to improve the efficiency of the compulsory social health insurance (CSHI) system in the healthcare sector.

The implementation of the Unified System of Payment for Medical Care (USMP) has begun in Republic of Kazakhstan. It represents an important stage in the transformation of financial mechanisms in the healthcare sector. The goal of this project is to ensure fair, transparent and results-oriented distribution of budget funds allocated for the provision of medical care to the population. The USMP is aimed at creating a financing model in which money "follows the patient", and the volume and quality of services rendered become the main criteria for remuneration of medical organizations.

The essence of the project is to create a unified digital platform within which information on each episode of medical care is collected, processed and analyzed - from the initial appointment to inpatient treatment and rehabilitation. These data form a single database on the basis of which the state pays for medical services. This approach allows for better cost management, reduced duplication and inefficient use of funds, and the elimination of subjective factors in decision-making on financing.

The peculiarity of the ESOMP is the transition from the traditional model, where funding was used to maintain healthcare institutions, to a model of payment for specific services and treatment results. This means that a medical organization is interested not just in the volume of care provided, but in its effectiveness and compliance with approved clinical protocols. The introduction of a unified approach to calculating tariffs, digitalization of patient routing, and automation of interactions between healthcare institutions, the social health insurance fund, and government

agencies - all this creates conditions for greater transparency and accountability.

In addition, the ESOMP is being implemented taking into account modern technologies, including fintech elements, which allows for automatic invoicing, prompt payment, and real-time data accounting. This significantly reduces paperwork, reduces the workload on staff, and minimizes the possibility of corruption risks. In the long term, the Unified Payment System should lead to the equalization of the quality of medical services between regions, increased motivation of medical institutions to improve their qualifications and introduce new treatment methods, as well as strengthening public confidence in the healthcare system.

The new digital tool will ensure quality control and financing of medical services provided within the framework of the State Fund for Medical Care and the Compulsory Medical Insurance. In March 2025, the pilot implementation of the Unified Payment System was launched in medical organizations of the Akmola region. From July 1, 2025, the new system will be implemented in all medical organizations of the country.

These systems are aimed at the efficient use of funds, the elimination of padding and a reduction in the share of corruption risks. The automated system for monitoring the quality of medical services will motivate medical organizations and the healthcare system to meet the needs of patients.

The prospects for improving the quality of medical services to the population in the context of the digitalization of the healthcare system are planned to be achieved by eliminating existing shortcomings, as well as introducing new, unique projects and information technologies.

One of such means is the correlation between all medical information systems, both public and private. These data should be accumulated within a single platform and be accessible to all medical organizations, include only reliable, complete and high-quality information about patients and medical services provided. In this regard, a comprehensive analysis of the activities of medical information systems and the level of their integration with each other is required.

The next proposal for improving the informatization process in the healthcare sector is the introduction of a single national platform interconnected with all medical organizations and medical information systems, accumulating all the necessary information.

One of the main advantages of digitalization is the complete rejection of paper document management. Based on the analysis of a sociological survey of employees of medical organizations, conducted as part of the preparation of this study, it was revealed that not all medical organizations have completely abandoned paper document management and switched to an electronic format. In this regard, it is considered appropriate to propose to conduct high-quality monitoring of the activities of medical organizations for the introduction of electronic document management and the rejection of paper documentation. But in order for this process to be painless and adequate, it is necessary to improve the work of information Internet portals, provide medical organizations with high-quality computer equipment (Zakon.kz, 2023).

Medical information systems store personal and confidential data about patients. In this regard, in order to exclude possible information leaks, it is necessary to continue work on the regulatory framework for the digitalization process in the healthcare system.

In addition, it is necessary to carry out work on the digitalization of administrative processes, including planning and monitoring the use of healthcare resources. Such resources include: medicines, medical products, procedures for the procurement of medical goods and services, human resources, and a system for organizing the activities of medical organizations (Baigenews.kz, 2025).

The next step in improving the informatization process in healthcare is the development of mobile applications. They should become a personal database of medical data, a convenient and accessible application for interaction between patients and medical organizations.

Thus, the main measures for improving the informatization process in

healthcare, improving the quality of medical services are:

- formation of a single digital space of the healthcare system;
- ensuring regulatory framework for the introduction of digital technologies in the healthcare system;
- integration between medical information systems;
- ensuring automation of public services in the field of healthcare;
- ensuring information security and protection of personal data of patients in medical information systems;
- providing the necessary equipment for the successful implementation of medical services using information technology. The results of this analysis revealed that digitalization processes have largely had a positive impact on the provision of medical services.

The study confirmed the need to improve the regulatory framework to create favorable conditions for private investors and protect the interests of patients. Technological and personnel aspects require additional attention, in particular, training of medical workers and development of infrastructure, which creates conditions for long-term and sustainable development of telemedicine.

Prospects for improving the quality of medical services to the population in the context of digitalization of the healthcare system are planned to be achieved by eliminating existing shortcomings, as well as introducing new, unique projects and information technologies.

One of such means is the correlation between all medical information systems of both public and private nature. These data should be accumulated within a single platform and be available to all medical organizations, include only reliable, complete and high-quality information about patients and medical services provided. In this regard, a comprehensive analysis of the activities of medical information systems, the level of their integration with each other is required.

The next proposal for improving the informatization process in the healthcare sector is the introduction of a single republican platform interconnected with all

medical organizations and medical information systems, accumulating all the necessary information.

Thus, telemedicine through PPP has all the prerequisites for transforming the healthcare system of Kazakhstan, improving its efficiency, accessibility and quality. Improving these processes will contribute not only to improving the health of the population, but also to strengthening the country's economic position in the international arena in the field of digital healthcare.

Conclusion

Digitalization in healthcare of Republic of Kazakhstan is one of the priority areas of state policy. The relevance of this issue is associated with the ever-growing need for high-quality medical services and their availability. The main goal of digitalization in the healthcare system is the introduction of electronic document management, thereby completely eliminating paper document flow. Digitalization in healthcare contributes to the formation of a complete database of patients, medical organizations and types of services provided that are available not only to employees of medical institutions, but also to patients.

Currently, medical information systems are being actively implemented in Kazakhstan. The first group of MIS is under the jurisdiction of the Ministry of Health of Republic of Kazakhstan. The second group is private developments. In addition, a number of electronic and mobile applications are operating.

As a result of the study on the impact of financial technologies on the financing and financial support of healthcare in Republic of Kazakhstan, a comprehensive picture of the current state of digitalization of medical services, the level of perception of fintech solutions by the population was obtained, and key factors facilitating or hindering their implementation were identified. The study confirmed the relevance and high importance of using financial technologies in the healthcare system as a tool that can improve the efficiency of resource allocation, ensure transparency of financial flows and simplify citizens' access to paying for medical services.

Data analysis showed that most citizens have a positive perception of the convenience of using fintech services, especially in terms of online payments, interface solutions and accessibility via mobile devices. At the same time, certain age, regional and professional differences demonstrate that the level of digital literacy and infrastructure provision still remain barriers to the uniform distribution of such solutions throughout the country. The level of trust in the security of fintech services

also requires attention: despite general trust, some users express concerns, especially among older age groups.

Additionally, an important influence of social factors - the opinions of medical workers and recommendations of their immediate environment - on the willingness of the population to use digital tools in healthcare was revealed. This emphasizes the need for more active involvement of medical personnel in digitalization processes and outreach work among patients.

Technical analysis, including SWOT analysis and developed proposals for the implementation of the LoRaWAN network to optimize financing, demonstrated the real potential of using fintech not only in the client, but also in the management aspect of healthcare. The integration of such technologies allows for real-time resource monitoring, automated reporting and increased transparency in the distribution of financing. Thus, it can be concluded that the introduction of fintech solutions in the healthcare sector of Kazakhstan is not only a timely measure, but also a necessary step to improve the sustainability and effectiveness of the healthcare system. Further development in this direction will require efforts to create a digital infrastructure, train personnel, adapt the regulatory framework and build trusting relationships with the population. Only an integrated approach will fully unlock the potential of financial technologies in solving the problems of fair and effective healthcare financing.

List of sources used

1. Filippov D.I., (2018). On the Impact of Financial Technologies on the Financial Market.
2. Gomber P., Koch J. A., Siering M., (2023). Digital Finance and FinTech: Current Research and Future Directions.
3. Oxford English Dictionary. (2021). Oxford English Dictionary // URL: http://www.oxforddictionaries.com/definition/english/fintech
4. Cambridge dictionary. (2023). Cambridge Dictionary // URL: https://dictionary.cambridge.org/dictionary/english/financial-technology.
5. Wikipedia. (2025). // URL: https://en.wikipedia.org/wiki/Fintech.
6. Adilet.kz. (2024). Law of the Republic of Kazakhstan "On Payments and Payment Systems" dated July 26, 2016 No. 11-VI ZRK // URL: https://adilet.zan.kz/rus/docs/Z1600000011
7. Zolotova E.A., Sherstyukova A.V., 2015. Development of the national payment system as an integrated and balanced process of the modern financial market.
8. Stat.gov.kz. (2025). Official website of the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan // URL: https://stat.gov.kz/ru/
9. Ncvb.kz. (2023). Results of healthcare work-2023: improving the quality of medical care and construction of new facilities // URL: https://ncvb.kz/news-page/itogi-raboty-zdravookhraneniya-2023-povyshenie-kachestvo-medpomoshchi-i-stroitelstvo-novykh-obektov
10. Inbusiness.kz. (2024). Financing of medicine from the budget of Kazakhstan // URL: https://inbusiness.kz/ru/last/v-2024-godu-finansirovanie-mediciny-iz-byudzheta-kazahstana-sostavit-2-8-trln-tenge

11. Gtmarket.ru. (2022). Rating of countries of the world by the level of expenditure on health care // URL: https://gtmarket.ru/ratings/global-health-expenditure
12. Sitnik A.A., 2019. The mechanism for financing scientific projects of the "MegaScience" class in Russia.
13. Cyberleninka.ru. (2021). Kodaneva S.I. Digital technologies in healthcare: foreign experience // URL: https://cyberleninka.ru/article/n/tsifrovye-tehnologii-v-zdravoohranenii-zarubezhnyy-opyt
14. Ilyasova A.R., 2019. Fundamentals of Healthcare Economics. Moscow: INFRA-M.
15. Arynova Z.A., 2018. The mechanism for forming the local government budget and sources of its income.
16. Kim A.A., Kurmanova G.K., Urazova B.A., Sukhanberdina B.B., 2019. Migration processes in modern Kazakhstani society.
17. Cyberleninka.ru. (2021). Tlembaeva Zh.U. On the legal regulation of the use of artificial Intelligence in healthcare of the Republic of Kazakhstan // URL: https://cyberleninka.ru/article/n/o-pravovom-regulirovanii-ispolzovaniya-iskusstvennogo-intellekta-v-zdravoohranenii-respubliki-kazahstan.
18. Cyberleninka.ru. (2021). Askarov K.K. Improving business processes in the e-healthcare system // URL: https://cyberleninka.ru/article/n7sovershenstvovanie-biznes-protsessov-v-sisteme-elektronnogo-zdravoohraneniya/viewer.
19. Spataev E.M., Romanova Zh.V., Yesenbaev B.S., 2018. Modern approaches to the formation of a national strategy for e-health
20. .Batsina E.A., Popsuiko A.N., Artamonova G.V., 2020. Application of the fundamentals of strategic management in healthcare practice.
21. Dudin M.N., Golyshko P.V., Vashalomidze E.V., Gurtskoy D.A., Gurtskoy L.D., 2022. Development of digital competencies of medical workers in the context of the general digitalization of Russian healthcare.

22. Komarov Yu.M., 2020. Key provisions of the Strategy for the Protection of Population Health of the Russian Federation for the period 2013–2020 and subsequent years.
23. Rcez.kz. (2025). Goals and objectives of the Republican State Enterprise on the Right of Economic Management "Republican Center for Electronic Healthcare" // Official website of the Republican State Enterprise on the Right of Economic Management "Republican Center for Electronic Healthcare" - URL: https://rcez.kz/aboutcompany.
24. Nur.kz. (2023). Report of the Vice Minister of Healthcare of the Republic of Kazakhstan Beibut Yesenbayev // URL: https://www.nur.kz/health/healthcare/2039456-beybut-esenbaev-nasha-osnovnaya-tsel-sdelat-tsifrovye-instrumenty-maksimalno-dostupnymi-dlya-naseleniya/
25. Rcez.kz. (2025). Healthcare information systems of the Ministry of Health of the Republic of Kazakhstan // Official website of the RSE on the Right of Economic Management "Republican Center for Electronic Healthcare" // URL: https://rcez.kz/informationsystems
26. Gov.kz. (2024). Official website of the Ministry of Health of the Republic of Kazakhstan // URL: https://www.gov.kz/memleket/entities/dsm/about?lang=ru
27. Medservice.kz. (2024). The Ministry of Health of the Republic of Kazakhstan summed up the results of the healthcare system for 2024 // URL: https://medservice.kz/novosti/tpost/cgr4cl9uz1-v-mz-rk-podvedeni-itogi-raboti-sistemi-z
28. Adilet.kz. (2023). Resolution of the Government of the Republic of Kazakhstan On approval of the national project "Quality and affordable healthcare for every citizen "Healthy Nation" dated October 12, 2023 No. 725 // URL: https://adilet.zan.kz/rus/docs/P2100000725
29. Kap.kz. (2025). Concept of development of healthcare of the Republic of Kazakhstan until 2025 // URL:

https://kap.kz/custom/wysiwyg/image/file/20210520/20210520000135_83290.pdf\

30. Adilet.kz. (2023). Resolution of the Government of the Republic of Kazakhstan On approval of the Concept of digital transformation, development of the information and communication technology industry and cybersecurity for 2023 - 2029 dated March 28, 2023 No. 269 // URL: https://adilet.zan.kz/rus/docs/P2300000269
31. Adilet.kz. (2022). Resolution of the Government of the Republic of Kazakhstan On approval of the Concept of development of healthcare of the Republic of Kazakhstan until 2026 dated November 24, 2022 No. 945 // URL: https://adilet.zan.kz/rus/docs/P2200000945
32. Leconomic.ru. (2023). Digital technologies in healthcare // URL: https://1economic.ru/lib/111400
33. Inform.kz. (2023). Health expenses per capita increased to 122 thousand tenge in the Republic of Kazakhstan // URL: https://www.inform.kz/ru/rashody-na-zdorov-e-odnogo-zhitelya-uvelichilis-do-122-tysyach-tenge-v-rk_a4069259
34. Bes.media. (2025). Why Kazakhstan will not reach the level of OECD countries - Akmaral Alnazarova spoke about healthcare financing // URL: https://bes.media/news/ispolnit-poruchenie-prezidenta-tokaeva-nevozmozhno-glava-minzdrava/
35. Halykfinance.kz. (2024). Deep problems of healthcare financing in Kazakhstan // URL: https://halykfinance.kz/analiticheskiy-centr/glubokie-problemy-finansirovaniya-zdravoohraneniya-v-kazahstane.html?lang=ru
36. Rcez.kz. (2025). Telemedicine // URL: https://rcez.kz/telemedicine
37. Nur.kz. (2023). The Ministry of Health spoke about the development of telemedicine // URL: https://www.nur.kz/health/healthcare/2042580-v-minzdrave-rasskazali-o-razvitii-telemeditsiny/
38. Kz.ambafrance.org. (2022). France will provide support to Kazakhstan in the implementation of telemedicine solutions // URL:

https://kz.ambafrance.org/Franciya-okazhet-Kazahstanu-podderzhku-vo-vnedrenii-telemedicinskih-reshenij

39. Zakon.kz. (2025). Changes in the compulsory medical insurance system: what is important for Kazakhstanis to know about the unified system of payment for medical care // URL: https://www.zakon.kz/obshestvo/6472787-izmeneniya-v-sisteme-osms-chto-vazhno-znat-kazakhstantsam-pro-edinuyu-sistemu-oplaty-medpomoshchi.html
40. Tengrinews.kz. (2025). Reforming the Compulsory Medical Insurance: A Unified Payment System is Introduced // URL: https://tengrinews.kz/kazakhstan_news/reformirovanie-osms-vvoditsya-edinaya-platejnaya-sistema-566948/
41. Uchet.kz. (2020). What is important for employers and employees to know about the Compulsory Medical Insurance in 2020 // URL: https://uchet.kz/news/chto-vazhno-znat-rabotodatelyam-i-rabotnikam-ob-osms-v-2020-god/
42. Egov.kz. (2025) Compulsory social health insurance (OSMS) // URL: https://egov.kz/cms/ru/articles/osms
43. 1cbit.kz. (2022). Calculation of wages in 2022 with examples // URL: https://www.1cbit.kz/blog/raschet-zarabotnoy-platy-v-2022-godu-s-primerami
44. Vasilenko, M.A., 2019. Features of the industry in the management of an advanced marketing complex.
45. Vc.ru. (2020). Digitalization of healthcare: main trends. Electronic resource // URL: https://vc.ru/future/159546-cifrovizaciya-zdravoohraneniya-osnovnye-trendy
46. Digitalbusiness.kz. (2024). By the end of the year, a unified medical IT system will appear in Kazakhstan: what else awaits the healthcare sector? // URL: https://digitalbusiness.kz/2024-10-03/do-kontsa-goda-v-kazahstane-poyavitsya-edinaya-meditsinskaya-it-sistema-chto-eshche-zhdet-sferu-zdravoohraneniya/

47. Univ-smb.fr. (2022). LoRa - LoRaWAN and Internet of Things for beginners // URL: https://www.univ-smb.fr/lorawan/wp-content/uploads/2022/01/Book-LoRa-LoRaWAN-and-Internet-of-Things.pdf
48. Thethingsnetwork.org. (2023). What are LoRa and LoRaWAN? // URL: https://www.thethingsnetwork.org/docs/lorawan/what-is-lorawan/
49. Zakon.kz. (2023). Kazakhstan has developed a Concept for the Development of Healthcare Infrastructure until 2030 // URL: https://www.zakon.kz/obshestvo/6409997-v-kazakhstane-razrabotali-kontseptsiyu-razvitiya-infrastruktury-zdravookhraneniya-do-2030-goda.html
50. Baigenews.kz. (2025). What has changed in the medical field in Kazakhstan in 2024 // URL: https://baigenews.kz/chto-izmenilos-v-sfere-meditsiny-v-kazahstane-2024-godu_300004279/

1. Appendices

Appendix A- Application Form

Block 1. Level of awareness and perception of the benefits of fintech services in healthcare

Questions in the survey:

1. Do you know about the existence of fintech services in healthcare (e.g. online payment for medical services, telemedicine, insurance via an app)?

2. Have you ever used fintech services in healthcare?

3. How useful do you think fintech services are in the medical field?

4. What, in your opinion, is the main advantage of fintech services in healthcare?

5. How much do you trust fintech services in medicine (on a scale from 1 to 5)?

6. What factors prevent you from using fintech services (you can select several)?

7. What fintech services would you like to see in the healthcare system?

Block 2. Ease of using fintech services in healthcare

Questions in the survey:

1. How convenient was it for you to use fintech services when visiting medical institutions?

2. Which elements of the fintech service interface seemed the most understandable to you?

3. Did you have any difficulties paying for medical services online?

4. What devices do you most often use when interacting with fintech services in healthcare?

5. What would improve your experience of interacting with fintech services in the medical field?

Block 3. Trust in technology and the safety of using fintech services in healthcare

Questions in the survey:

1. How much do you trust the use of fintech services to pay for medical services in Kazakhstan?

2. How do you rate the level of security of fintech services in healthcare?

3. What security measures do you expect from fintech services in healthcare?

4. How important is it for you to have information about the protection of personal data when using fintech services?

5. Do you feel that fintech services in healthcare may increase the risk of cybercrime?