

Digital transformation in the health sector

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Abstract

It is known that information technology has invaded all areas of life without exception, whether civil or military.

The digital transformation is considered one of the arms of information technology that appeared in some sectors, which had an effective role in the process of transforming the facilities into what is known as digitization, which works to transfer the facility a qualitative leap in terms of the implementation of tasks, procedures and customer services.

This research came to shed light on the role of digital transformation in the health sector, which includes some areas, including artificial intelligence, which includes (Internet of things and robot technology), big data, electronic file management systems that are used in the medical fields.

Some examples that use these techniques have also been included, with an indication of the extent of the impact of this technology on the quality of services provided in the medical field, in addition to that, some problems that hinder the application of digital technology in the medical field have been clarified.

Keywords:Digital transformation, file management systems, Internet of things, robot technology, techniques, application.

Introduction:

Innovation activity in its dynamic development is associated with revolutionary transformations, in particular, with high technologies, the emergence and improvement of which has had and has a radical impact on all spheres of society [8]. The gradual development and application of technologies in the field of information creation, storage, processing and transmission has led to the transformation of the models of relations between producers of goods, works and services, on the one hand, and end users, on the other.

The root causes and speed of implementation of innovative technologies are dictated by modern needs. The twenty-first century was marked by digitalization in all industries, we observe "a mixture of technologies of the physical, digital and biological world" [1], contributing to the emergence of innovative opportunities for the development of society, which accelerates production and other processes, increases the speed of data transfer, promotes the integration of various information systems and their effective management [2].

Thanks to the introduction of breakthrough technologies, production processes are being transformed, new goods and services appear, and living conditions are improving. "Simultaneously, waves of further breakthroughs are emerging in a wide variety of areas: from decoding information recorded in human genes to nanotechnology, from renewable energy resources to quantum computing" [3]. Innovative technologies based on the exponential growth of computing power, information resources, software affect all spheres of society, improving the quality of life of people.

Information hygiene as a tool to preserve the health of workers and the population in the digital age:

In the 1990s, information ecology began to form (Capurro R., 1990; Eremin AL, 1995, etc.), and then information hygiene as a new section of preventive medicine [4].

Based on the analysis of the influence of the information environment on children and adolescents, the question is raised about the development of psycho-hygienic technologies for working with information in order to resist the destructive impact of mass culture and use the capabilities of the virtual environment [5].

In the FSBSI "NII MT" informational loads (IU) have been studied as a new hygienically significant physical factor [5], methodological materials and computer programs have been created to assess both the IU itself and the mental load from it; they are included in the professional risk electronic library (<http://medtrud.com/>). This creates the basis for research to determine the physical criteria for the hygienic assessment of IN - textual, audiovisual, and especially from DVR devices.

It is advisable to conduct large-scale physiological and hygienic research in this area for the development of Guidelines or Sanitary Rules for the hygienic assessment and limitation of informational loads on workers and the population, similar to guidelines R 2.2.1766-03 and R 2.2.2006-05. It would be a new tool for introducing professional risk assessment into the practice of Rospotrebnadzor in the implementation of state sanitary and epidemiological supervision for effective risk management and development of innovations in the country.

Augmented and virtual reality (AVR):

Augmented reality (AR) and virtual reality (AR-VR) technologies are developing rapidly. Created by the AVR Association (<http://ar-vr.org/>), a community of companies and individuals in industry, it develops and promotes interactive computing technologies and their use to improve people's quality of life and increase the efficiency of life. Profession. There are over 200 companies in the industry, studios from 3 to 20 people that set the tone, and clients [6].

AVR technology presents virtual information in the three-dimensional field of human perception, which is perceived as elements of reality through audio-visual channels (headphones, special glasses, helmets, etc.).

Its 10 years or more ahead of VR, but VR is now more accessible to users.

Moreover, in Japan, they set up virtual reality booths where you can feel the rain or the scorching sun.

Not only have DVR technologies become entertaining, they are being used in education, industry, architecture, etc., and are increasingly being introduced into medicine and affecting medical sciences: spinal surgery simulation, chronic pain reduction, gerontology, medical student training. [7]. However, despite a number of advantages, DDA techniques require special attention from hygienists, because there is more and more work on the negative consequences of their impact on well-being and health, especially on vulnerable groups of workers and the population [8].

The concept of innovation and its role in the advancement of health fields:

One of the promising vectors of innovative development, taking into account the use of digital technologies, is innovation in the healthcare system. Traditional healthcare is undergoing significant changes associated with the application of new areas of biomedicine, the possibility of studying the effect of specific gene variations on various pathologies in medicine, conducting remote consultations, digital transfer of personal data, maintaining electronic patient records, etc.

The formation and development of information and communication systems in the industry began to be considered at the end of the last century. Legislative and regulatory instruments for the development of information and communication technologies in healthcare in the context of the formation of the digital economy are presented in Table 1.

Name
Creation of a unified system of informatization in health care "
"Approval of the principles of creating a unified information system (UIS) in the field of health care and social development"
Strategies for the development of the information society in Jordan for 2017-2030 "
approval of the program "Digital Economy of Jordan"
Amendments to certain legislative acts of Jordan on the application of information technologies in the field of health protection "
The list of services in the field of healthcare, the possibility of providing which to citizens in electronic form through a single portal of state and municipal services is provided by a single state information system in the field of healthcare "
Approval of the Rules for the interaction of other information systems designed to collect, store, process and provide information regarding the activities of medical organizations and the services they provide, with information systems in the healthcare sector and medical organizations "
Unified state information system in the field of health care "
National goals and strategic objectives of the development of Jordan for the period up to 2024 "
Development of artificial intelligence in Jordan "
Approval of the Procedure for organizing a workflow system in the field of health protection in terms of maintaining medical records in the form of electronic documents "
Accelerated registration of digital platforms in healthcare "

Table 1- Legislative and regulatory instruments for the development of information and communication technologies in healthcare.

In "The Long-Term Strategy for the Development of Health Care in Jordan 2015-2030". It was emphasized that at the current stage, "the health care system is impossible without the development of informatics, the widespread introduction of the electronic medical information system, the personal account of the patient, the workplace of the doctor and nurse, electronic decision-making assistance systems and access to electronic information and training resources, as well as medical technologies remotely" [9].

The foundation of digital transformation in healthcare should be a favorable innovation environment that contributes to the improvement of the digital infrastructure of the industry, based on complex information systems. At the same time, the primary task is to connect all healthcare structures to high-speed Internet in the near future. The penetration and diffusion of information

and communication technologies into the activities of medical organizations leads to the transformation of traditional healthcare and the development of new vectors in many areas (Table 2).

Directions	The description
Internet of Medical Things (IoMT)	IoMT (Internet of Medical Things) - connection and computerization of various systems, their full automation through the use of the Internet, which monitor the state of the human body and its environment, including medical devices that can interactively influence preventive, therapeutic and rehabilitation processes [7]
Telemedicine	The use of telecommunication and computer technologies for online consultations and the exchange of medical information, providing remote interaction of doctors with each other, a doctor and a patient, remote monitoring of the patient's health [1], treatment, consultations and continuous training
Big Data	Innovative analytical tools for the processing and analysis of medical data arrays based on the integration of high-tech diagnostic equipment, information and computing systems, which makes it possible to establish a more accurate final diagnosis in a shorter time, organize the treatment procedure in a timely manner, monitor the effectiveness of medical services, determine the risks of complications of the disease, and also optimize the activities of health care institutions
Artificial intelligence	The possibility of early and highly accurate diagnosis of diseases based on applications and software products for the recognition of medical images (results of CT, MRI, ultrasound, ECG), the development of precision medicine (individual treatment taking into account genetic characteristics)
3D printing	Additive technologies for the creation of innovative medical materials for replacing human organs, the production of necessary surgical instruments, the manufacture of prostheses. These technologies are highly accurate when creating custom-based products.
Robotics	Cybernetic models and systems that provide surgical interventions, constant monitoring of the patient's health, delivery of drugs directly to the affected organs, etc.
5G networks	Innovative networks for working online, they allow you to organize remote monitoring of a surgical operation, fast transfer of images with analysis results
Blockchain mechanisms	Innovative ways of integrating customer information within one information system, allowing to transfer work to a digital environment, provide quality medical care, quick diagnosis, personalized approach

Table 2- New directions of digital transformation of medicine.

Technological aspects of the health sector:

Interest in the Internet of medical things is expanding every year; more than 60% of healthcare institutions in the world are actively using these innovative technologies. For example, in the United States, IoT sensors have been created aimed at reducing the number of cases of nosocomial infection and monitoring the sanitation of the hands of health workers with disinfectants before and after communicating with patients. The sensors are built into the badges of the nursing staff and the disinfectant dispensers, and when the paramedic enters the patient's room, the smart device beeps and starts counting the time during which you need to treat your hands.

This technology "Clean hands - safe hands" has reduced the number of nosocomial infections in clinics by 66% [10]. There are examples of other "smart" devices. For example, the Rhythm + 2.0 bracelet (Sosche Industries) is a monitor that monitors heart activity; it has built-in blood flow measurement devices. In addition, for example, Leman Microdevices has developed a technology for measuring blood pressure, which is integrated into a smartphone (the measurement takes place after touching the sensor with a finger).

Artificial intelligence in healthcare is one of the most important vectors of development.

It radically transforms the diagnostic system, automating and increasing its accuracy. Therefore, it gives up to 96.5% accuracy in the diagnosis of ulcerative pathologies, up to 93% - when processing radiological images. The use of artificial intelligence makes it possible to identify at an early stage patients with a high risk of diseases, and to develop preventive treatment measures.

For example, MedyMatch Technology, using artificial intelligence and big data technologies, has created an innovation that can more accurately detect stroke [11].

In addition, artificial intelligence makes it possible to optimize the activities of medical institutions based on the automation of many routine processes, which will entail an increase in the level of patient care and an improvement in the work of staff. It is assumed that by 2025 the use of artificial intelligence in medicine will grow 7 times, and by 2027 the global medical Internet market will also grow 7 times.

3D printing is actively developing. In 2018, scientists at Newcastle University 3D printed the cornea of the eye. In the same year, smartARM presented a self-learning robotic arm prosthesis, winning the Microsoft international technology competition.

Imagine Cup 2018. Institute of Traumatology and Orthopedics. R.R. Vredena, together with ETU "LETI", developed and created because of 3D printing a hip joint prosthesis made of titanium, and specialists of the Institute of Light Materials and Technologies, which is part of Rusal, in September 2020 - bioprotheses from aluminum powders, Rosatom in July 2020 - spine implants.

At the end of March 2020, Consorci de la Zona Franca, HP Inc., Leitat and CatSalut (Spain) developed the first 3D-printed emergency ventilation device, much needed in a pandemic. During the epidemiological situation in 2020, WinSun developed infectious isolators based on 3D printing [12].

The role of robotics in healthcare is obvious and beyond doubt, robots perform monotonous, repetitive work related to measuring health indicators, registering patients, and disinfecting premises. Thus, the Omnicell M5000 robot generates the prescribed sets of drugs for patients, arranging them into blisters, while its speed is 50 sets / hour, and the health worker performs this 10 times slower (4-5 sets / hour). The high-tech innovative system "da Vinci" is used to perform the most complex operations, obeying the surgeon's commands. In modern epidemiological conditions, the role of robots is increasing. Another direction in the development of robotics is exoskeletons, which are used to restore weakened muscles. They are needed both for the rehabilitation of patients after injuries and for the elderly to return movement.

With the development of IT technologies, remote assistance to a patient and doctor is gaining momentum, it not only creates an opportunity to monitor the condition of patients remotely and conduct telemedicine consultations (both emergency and planned) for remote regions by more experienced and competent doctors in various medical fields, but and allows you to reduce the waiting time for the appointment of highly qualified specialists.

At the BIOTECHMED-2019 forum, a remote video consultation system created because of Integro Technologies was demonstrated, thanks to which it is possible to attract specialists from any country to the treatment. The active development of telemedicine was prompted by the modern epidemiological situation, so according to the forecasts of experts "the attendance of telemedicine services in the world may grow 5.5 times - from 36 million visits at the beginning of 2020 to 200 million visits by the beginning of 2021 ". Recently, doctors have provided more than 2.5 thousand daily consultations per day, with more than 70% referring to narrow-profile specialists, and consultations on Covid-19 make up less than 5% [13].

5G networks of the new generation allow performing surgical procedures remotely, that is, there is no need to transport a patient or a specialist from clinic to clinic. Remote consultations based on 5G communication significantly save doctor and patient time: nowadays doctors spend more than 70% of their time traveling from one place to another to solve problems in difficult cases.

The use of blockchain technology in healthcare makes it possible to store patients' medical data in the form of electronic medical records, which makes it possible to increase their security and integrate the data into a single database. For example, SimplyVitalHealth (USA) has developed a system for the exchange of patient data between several clinics (decentralized information ecosystem). This system informs about the nature of visits to doctors, the prescription of drugs and treatment. This makes it possible to provide better medical care. In addition, blockchain technology is able to control the movement of medicines from the manufacturer to the retail network[14].

The innovative health situation in Jordan:

In our country, serious work is underway to develop health information systems, so the Ministry of Health has allocated a part of its budget to developing health information and communication infrastructure; because the health situation has not yet reached the required level.(Table 3).

One of the problems is the low quality of the Internet connection in the remote regions of the country. The development of wireless broadband access using modern technologies (cellular mobile telecommunication networks for the use of 5G technology), fiber-optic communication lines (for Big Date technologies), cloud technologies remains relevant [15]. The limiting factors for the development of digitalization in the industry include the unavailability of using digital services; conservative thinking of older healthcare workers, their distrust of innovative approaches to treatment and interaction with patients; poor quality of images obtained from patients (which creates problems in establishing a diagnosis); lack of financial capacity of clinics to purchase the latest medical equipment and software [16], lack of a well-thought-out and effective regulatory framework associated with the introduction of innovative technologies in medicine.

Activity	2018 (Million dinars)	2019 (Million dinars)	2020 (Million dinars)
Development of health informatization	2	3	3.5
Development and integration of information systems for medical organizations, central systems of state constituent entities and information systems to create a unified state health information system	3	2.5	2
Develop information support systems, means and communication networks	2	3	2

Table 3. Financing activities aimed at informing health care (million dinars).

Conclusion:

New trends associated with the transformation of the healthcare system based on digitalization are radically changing the usual interaction between medical institutions and patients, opening up new opportunities for both medical personnel and patients, allowing, based on "smart technologies" to increase the speed and accuracy of diagnostics, to attract consultations and treatment of specialists from anywhere in the world, improve the organizational activities of medical institutions based on the creation and use of medical electronic databases, electronic document management, electronic prescriptions.

Despite the conservatism of the healthcare industry, the presence of a number of unresolved problems, the rapid development of IT technologies and methods of processing big data, artificial intelligence entail radical transformations in the diagnostic system, the creation of innovative developments, automation and optimization of business processes, which contributes to improving the quality of medical care. Services.

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