

DIGITIZATION AS A SOURCE OF BENEFITS IN THE HEALTHCARE SYSTEM – A REGIONAL APPROACH

Jadwiga KACZMARSKA-KRAWCZAK

Military University of Technology; jadwiga.kaczmarska-krawczak@wat.edu.pl,
ORCID: 0000-0002-0471-0873

Purpose: The main objective of this article is to identify the implications of digital technologies for the practices of healthcare organizations. The author evaluates the benefits arising from the potential use of digitization for patients, healthcare workers, and the healthcare system.

Design/methodology/approach: The article utilizes a literature review and presents the findings of original research conducted on the digitization process in hospitals, using the example of the Łódź Voivodeship. The intended goal was achieved through the application of computer-assisted telephone interviews (CATI).

Findings: In recent years, significant changes in the digitization of the healthcare sector have been observed. The research results demonstrate that, in the context of the epidemiological situation, these transformations have accelerated even further, leading to the positive development of innovative digital solutions in the field of medicine.

Practical implications: The healthcare system engages a substantial number of human and financial resources. The challenges arising due to an aging society, epidemic crises, and increasing citizen expectations are the most important issues that the healthcare system needs to address. Fostering innovation in healthcare digitization, as well as enhancing the skills of healthcare workers, increasing efficiency, and ensuring the sustainability of the healthcare and medical care system, all constitute steps towards improving public health and access to medical services.

Originality/value: This article presents original empirical research findings on the benefits resulting from the implementation of digital technologies in hospitals. It is aimed at all parties involved in the healthcare sector to raise awareness of the need for further digital technological changes in this field.

Keywords: digital technologies, digitization, health system care.

Category of the paper: Research paper.

1. Introduction

Healthcare systems around the world are grappling with problems, with aging societies and Western lifestyles heavily contributing to the increase in healthcare spending (Schütte, Acevedo, Flahault, 2018). Entities providing medical services under severe financial constraints must address the challenges associated with epidemic crises and increasing citizen expectations. Fostering innovation in healthcare digitization is thus a step towards improving public health and access to medical services, as well as enhancing the skills of healthcare workers, increasing efficiency, and ensuring the sustainability of healthcare and care systems. In many international rankings comparing healthcare systems, the Polish system ranks among the lowest in the European Union. According to the “Future Proofing Healthcare” report, Poland ranked 23rd out of 30 EU countries in the Sustainable Development of Health Care Systems Index (Future Proofing Healthcare..., 2021). The COVID-19 pandemic has only intensified the flaws of the healthcare system in Poland, leading to an increased demand for healthcare services and a deterioration in access to medical services, particularly specialist ones. A study on digital health in the EU conducted by the French Ministry of Health and Solidarity reveals that 25 out of 29 countries covered by the study have already implemented national digital health strategies, among them Poland. Most countries have defined strategic goals and development directions for digitization focused on “creating a patient-centered healthcare system” (Study on Digital Health..., 2022). The future of healthcare should be based on pillars such as people’s well-being and prevention, shifting the focus from reactive healthcare approaches to proactive measures. It cannot be expected that diseases will be completely eliminated, but the use of digitization tools based on interoperable data and artificial intelligence can help detect diseases at an early stage and enable swift intervention, thus reducing healthcare expenses. Digital technologies can also overcome barriers such as costs and geographical location, which are among the most common limiting factors when it comes to accessing specialist doctors.

The aim of this article is to present the directions for the development of the healthcare sector in the context of modern technological solutions, with a particular focus on digital solutions, and to indicate the benefits of implementing digital tools for patients, medical personnel, and entities operating in the healthcare system, using the example of the Łódź Voivodeship.

The article utilizes a literature review and presents the findings of original research regarding the digitization process in hospitals in the Łódź Voivodeship.

2. The Role of Digitization in the Transformation Process of the Healthcare System

The ongoing scientific and technological revolution, driven by digital technologies, has led to the emergence of the so-called information civilization and has changed the way services are perceived and treated. Digitization has become a driving force, energizing the economy and the organizations within it, motivating leaders to undertake interventions to improve current operations, enhance quality, and open up new possibilities for creation and transformation their performance. As a result, products, services, processes, as well as management concepts and organizational structures undergo changes (Matt et al., 2015). Digital transformation serves as the foundation for initiatives related to the Fourth Industrial Revolution, proposed as the next stage of development for many organizations supported by the governments of the European Union, China, and the USA (Liao et al., 2017). Their further development aims for continuous interaction and even coexistence of the virtual and real world, where humans collaborate with machines, achieving unprecedented effects (Śledziwska, Włoch, 2020).

Digitization leads to the integration of advanced technologies into all processes, products, and services, driving organizations to transform organizational elements tailored to the previous era, dominated by human interactions (Parida, 2018). This brings about sudden and rapid changes that impact the values guiding the members of organizations and their external partners. Many organizations are not ready to undergo these changes, as the broad scope and transformative nature may be perceived as a threat.

The definition of digitization itself has not yet been fully formed, as indicated by the interchangeable use of terms like digitization and digital transformation, as well as the multitude of perspectives present in the literature. The diversity of definitions is particularly noticeable depending on the industry for which they were developed. According to Wysokińska (2021), digitization depends on organizations adopting technologies such as artificial intelligence, robotics, big data, machine learning, the Internet of Things, or blockchain. Zimnoch (2021) identifies several paths of digital transformation, distinguishing between successive stages: digitalization, digitization, and digital transformation. Digitization is seen as an innovation that focuses on progress in information-related processes. The implementation of digital technologies leads to the transformation of processes within organizations and influences the redefinition of society's way of life. Wiktor et al. (2021) argue that digital transformation is a coherent combination of sudden and rapid changes in technological methods used and value creation, accompanied by equally significant social changes. Digital transformation encompasses technical aspects and involves replacing analog technologies with digital systems, as well as social transformations resulting from technological changes, providing the background for the acceptance and transformation of organizations. The basic techniques that make up digitization include (Pieriegud, Paprocki, Zawieska, 2016):

- ubiquitous connectivity, the Internet of Things, and the Internet of Everything,
- cloud-based applications and services,
- big data analytics and big data as a service,
- automation and robotics,
- multichannel and omnichannel models of product and service distribution.

A review of the literature identifies certain elements that are common to different definitions of digitization. Firstly, the aim of digitization is to improve the performance of organizations in terms of higher added value resulting from better communication with customers and more efficient and effective operational processes. The method of achieving these goals involves modifying the organization, primarily its strategy, structure, and culture. These elements are introduced through broadly understood information technologies that constitute digitization. These changes are not one-time events but rather evolutionary, suggesting that if an organization embarks on the path of digitization, the values guiding its development gradually change. Therefore, when we talk about digitization, we mean a true transformation of the entire organization. To fully leverage digital technologies, organizations need to prepare for a complete transformation of their entity.

In EU documents, the need for the use of technological solutions in healthcare is emphasized. The “EU4Health Programme”, with a budget of 5.3 billion euros for the period 2021-2027, represents unprecedented financial support from the European Union in this field, indicating that public health is a priority for the EU. It was established in response to the COVID-19 pandemic with the aim of increasing readiness for crisis situations. It aims to address long-term health challenges by building stronger, more resilient, and more accessible healthcare systems (<https://health.ec.europa.eu...>, 2021). Establishing a unified single market, within which actions for the development of e-health are supported, is a key priority. From 2021 to 2027, the European Union implements the “Digital Europe Programme,” which aims to support the digital transformation of European society and the European economy, providing various benefits to EU citizens and organizations. The program strengthens Europe's capabilities in key areas of digital technology and enhances their dissemination and uptake in public interest areas and the private sector (<https://health.ec.europa.eu...>, 2021). Another program, under the slogan “No dreams for the European Health Union without a tippel www,” plans to increase activities and funding sources for the development of healthcare based on information and communication technologies (Regulation the European Parliament..., 2021). At the national level, the e-Health Development Program implemented by the Polish Ministry of Health aims to better utilize data and utilize artificial intelligence, among other things, to provide medical staff with guidance on areas requiring greater attention. The program implements the development of central systems (including patient services) as well as provider systems, which will also be used by healthcare professionals (Program Rozwoju E-Zdrowia..., 2022). At the regional level, the Health Policy Strategy for the Łódź Voivodeship for the years

2021-2027 includes improving the quality of healthcare units through infrastructure improvements and increased utilization of modern technologies and digital solutions (Uchwała Nr 738/21..., 2021).

In many international rankings comparing healthcare systems, the Polish system ranks among the lowest in the European Union (Raport: System ochrony zdrowia..., 2019; Future Proofing Healthcare..., 2021; State of Health in the EU Poland..., 2021).

3. Material and methods

Between January and April 2021, a study was conducted using Computer-Assisted Telephone Interviews (CATI), with the aim of presenting the directions of development in the healthcare sector in the context of modern technological solutions, with a particular focus on digital innovations and the benefits of implementing digital tools in healthcare entities. The selection of entities for the study was based on a non-random purposive sampling method, targeting healthcare units. The study was conducted on a sample of $N = 57$ entities operating in the Łódź Voivodeship. According to Article 2(1)(9) of the Act of April 15, 2011 on medical activity, a hospital is a healthcare entity where medical activities of a hospital nature are performed, as well as comprehensive 24-hour healthcare services involving diagnosis, treatment, care, and rehabilitation that cannot be provided within other stationary and round-the-clock healthcare or outpatient services. Table 1 and Table 2 present the characteristics of the entities participating in the study, categorized based on their organizational affiliation (e.g., local government units such as voivodeships, counties, or municipalities, the Ministry of Health, the Medical University of Łódź, the Ministry of the Interior and Administration) and their profiles.

Analyzing the research sample in terms of ownership, it can be observed that the predominant form was entities owned by county or municipal self-governments (47.36%), followed by voivodeship self-governments, accounting for 36.84% of the sample. The group also included entities with the Medical University as the owner (12.29%), as well as the Ministry of Health and the Ministry of the Interior and Administration (3.51%).

Table 1.

The number and structure of surveyed hospitals according to the ownership body

Ownership	%	The Number of Hospitals Participating in the Study
County or Municipal Self-government	47,36%	27
Voivodeship Self-government	36,84%	21
Medical University of Łódź	12,29%	7
Ministry of Health, Ministry of the Interior and Administration	3,51%	2
TOTAL	100%	57

Source: Author's own research.

When characterizing the surveyed group of hospitals, attention was also paid to the profile of their activities. In the overall sample, multispecialty entities were found to be dominant (89.48%), while the remaining portion consisted of single specialty hospitals (10.52%).

Table 2.

The number and structure of surveyed hospitals according to their specialty profiles

Specialty Profiles	%	The Number of Hospitals Participating in the Study
Multispecialty Hospitals	89,48%	51
Single Specialty Hospitals	10,52%	6
TOTAL	100%	57

Source: Author's own research.

With the aim of obtaining reliable information from hospitals and highlighting the benefits of digitization in healthcare entities, interviews were conducted with representatives of the management team who were directly responsible for the implementation of digital technologies.

4. Results and discussion

During the conducted research, a hypothesis was formulated, assuming that under the influence of digital transformation, the management approach of healthcare entities undergoes changes. In order to increase the efficiency of operations and the effectiveness of employees' work, it is necessary to introduce changes that allow for a more optimal utilization of limited resources.

Regarding the implementation of digital tools in hospitals operating in the Łódź Voivodeship, it was primarily the management staff of the hospitals who initiated the digitization processes.

Analyzing the types of digital solutions, the chart below presents the digital tools implemented in hospitals.

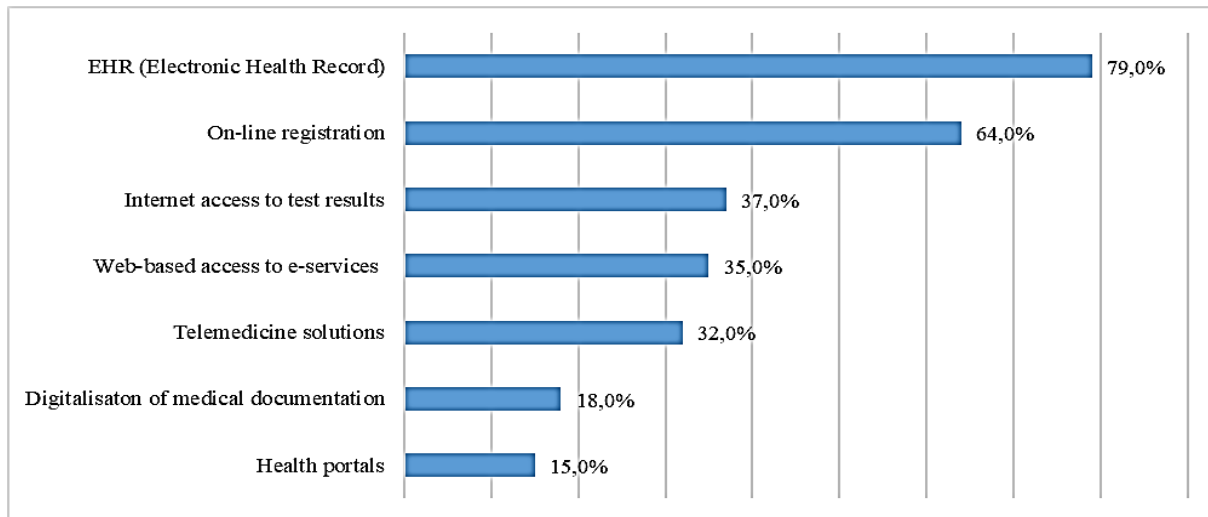


Figure 1. The digital tools implemented in hospitals.

Source: Author's own research.

79% of hospitals declare that they have implemented an Electronic Health Record (EHR) platform, which contributes to improving the quality and expanding the scope of stored medical data, as well as eliminating excessive and duplicating reporting obligations imposed on healthcare entities. It allows for processing individual medical data relevant to patients and healthcare providers involved in the treatment process, including the course of treatment, types of procedures performed, and laboratory and diagnostic test results. 18% of entities digitize paper-based documentation and store it in electronic form. 64% of entities have implemented an e-registration service, which allows for online registration to reserve appointments for diagnostic tests, specialist doctors visits, or hospital admissions.

35% of the surveyed entities indicate that in their facilities, patients have access to e-services through the website. E-services based on doctor-patient relationships involve the diagnosis and monitoring of patients' health, telemedical consultations, e-prescriptions, and e-referrals. By utilizing e-services, medical personnel save time that can be used to accommodate additional patients. This also contributes to reducing and relieving queues for specialist doctors appointments, resulting in shorter waiting times for appointments or medical examinations.

Telemedicine solutions, which have been implemented by 32% of the respondents, is another digital tool utilized in hospitals. Telemedicine, as one of the directions of digitization, promotes the development of home and community-based care, as well as the optimization of the medical services pyramid, which supports patients and their caregivers in their daily functioning.

Health portals are the least indicated digital tool implemented by healthcare organizations (11% of responses). Designed for patients, these portals aim to support them in maintaining a healthy lifestyle and engaging in preventive and diagnostic screenings.

Research findings indicate that the implementation of digital tools in the healthcare sector is associated with numerous positive implications for the healthcare system.

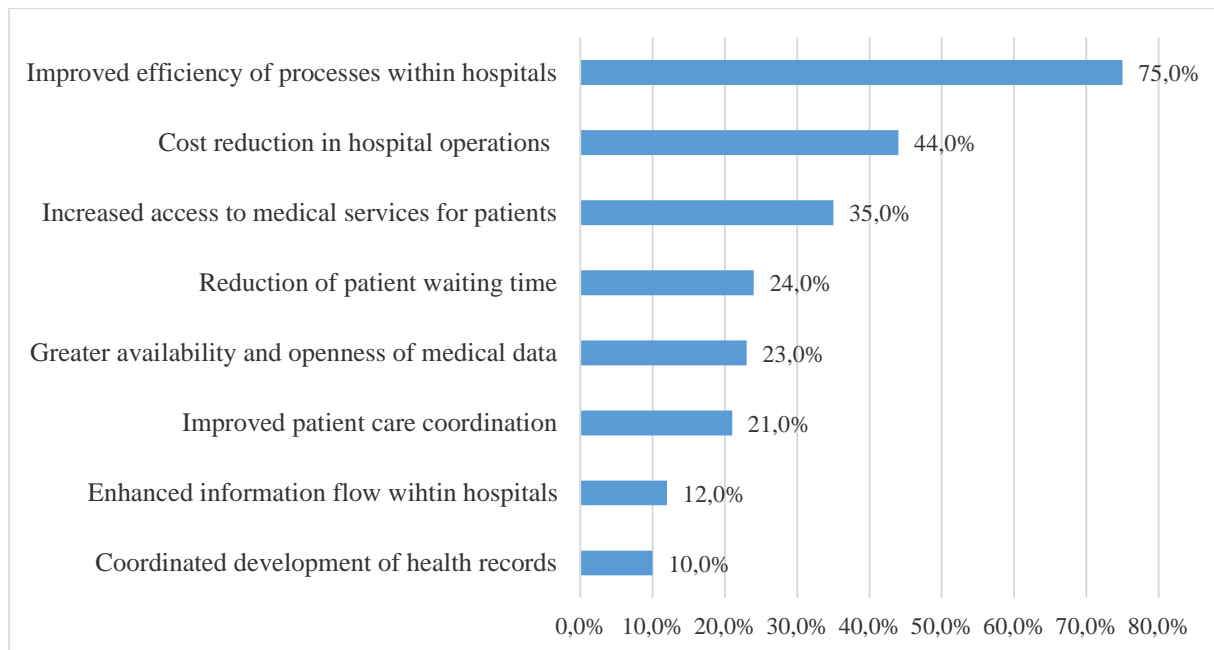


Figure 2. The benefits of implementing digital tools for the healthcare system.

Source: Author's own research.

According to 75% of respondents, the implementation of digital tools improves the efficiency of processes within hospitals. 44% of entities stated that digitization allows for cost reduction in hospital operations. 35% of respondents indicated that the use of digital tools in hospitals increases the access to medical services for patients. According to the respondents, digitization reduces waiting time for consultations/appointments (24% of responses) and improves the accessibility and openness of medical data (23% of responses), resulting in the development of transparent rules and methods for sharing data for diagnostic, therapeutic, research, and developmental purposes that are beneficial for all parties involved in the healthcare system.

The implementation of digital tools in hospitals also improves patient care coordination (21% of responses) and enhances the flow of information between healthcare entities (12% of responses) within the healthcare system. In patient care coordination, digitization instruments enhance collaboration with other healthcare entities such as Primary Healthcare (POZ), Outpatient Specialist Care (AOS), and Health Care Centers (ZOL). They support healthcare professionals in coordinated patient care, providing solutions that optimize the utilization of available resources and facilitate value-based care delivery. They engage patients in the treatment process, allowing monitoring of adherence to the treatment plan and progress in health improvement. The flow of information enables the exchange of orders, data, and medical documentation among all participants in the healthcare system and provides patient feedback on satisfaction and the assessment of the quality of services rendered.

Digitization in the healthcare system also contributes to the establishment and development of medical registries (10% of responses), enabling the monitoring of treatment quality, including the registration of adverse events and the exchange of information between system entities.

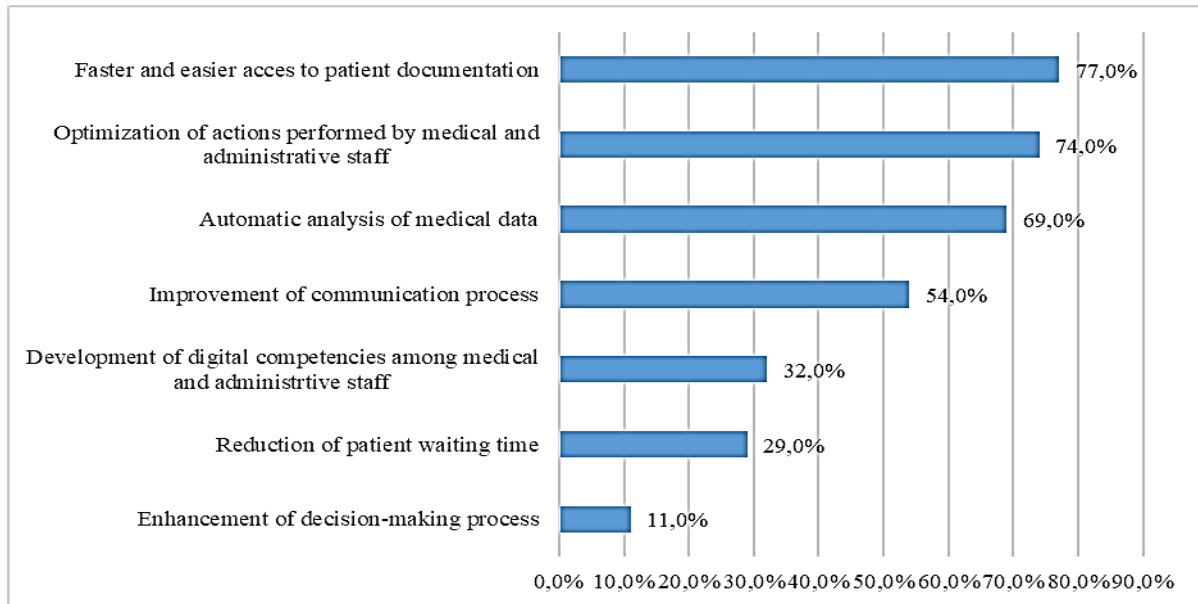


Figure 3. The benefits of implementing digital tools for employees.

Source: Author's own research.

Additionally, it is crucial to note that the implementation of digital tools in hospitals brings benefits for employees. The highest percentage of responses (77% indications) is faster and easier access to patient documentation, as well as optimization of actions performed by medical and administrative staff (74% responses). The implementation of digital tools in hospitals is a necessary condition for building an efficient healthcare system. Moreover, it streamlines the work of doctors, nurses, and pharmacists. The more advanced the digital tools, the better the process of patient diagnosis and treatment. Digitization contributes to the automatic analysis of medical data, as indicated by 69% of the participating hospitals in the study. As a result, transparent principles and methods for sharing medical data are developed, which improves the healthcare process.

As per 54% of entities, digitization improves the interaction between patients and healthcare professionals, providing patients with clear information about their healthcare history. According to 32% of respondents, digitization contributes to the development of digital competencies among medical and administrative staff, while 29% of participants believe it reduces patient waiting times and improves the efficiency of care. Moreover, digitization positively influences the decision-making process, with 11% of respondents emphasizing its role in supporting clinical decisions and enhancing diagnostic effectiveness.

The presented studies indicate that the pandemic has acted as a catalyst for the adoption of digital tools in healthcare institutions in the Łódź Voivodeship. The use of digital technologies has become even more prominent as a result of the COVID-19 outbreak. Digital tools have facilitated the rapid implementation of solutions to address the challenges posed by the virus, particularly in situations where minimizing direct contact and enabling individuals to stay at home during isolation or quarantine was necessary. Digital technologies contribute to increased investments in healthcare and help reduce costs while improving the quality of care. They are focused on facilitating information flow, exchanging medical data, and coordinating medical services between staff and patients.

The research findings presented in this article align with other studies in this area. The digitization benefits include the positive impact of digital technology on support (Givertz et al., 2017) and improvement of treatment outcomes for patients (Schmier, Ong, and Fonarow, 2017, pp. 430-436; Givertz et al., 2017), as well as the reduction in hospitalization time, cost reduction, and increased access to medical services (Davis et al., 2016). In some cases, better adherence to therapeutic recommendations has been demonstrated through the use of telemedicine tools in the treatment process. The influence of the pandemic on accelerating digitization processes has been emphasized across various contexts.

Drawing upon emerging technology, it is certain that digital transformation plays a significant role in driving substantial changes in healthcare. Therefore, there is an absolute necessity for further development of digitization to create conditions that enable increased access to modern medical technologies, allowing for treatment in line with European guidelines. Efforts should be made to strengthen digitization initiatives, enhance their coordination, and utilize more advanced e-health solutions, while striving for their sustainable implementation. As a result, the functioning of the healthcare system will be improved, enabling rapid diagnostics, timely interventions in treatment, and the possibility to embrace value-based healthcare concepts. This will optimize resource utilization, enhance long-term access to services, and foster the development of a patient-centric system.

5. Conclusions

Digitization poses a significant challenge for healthcare entities, requiring them to undergo profound changes in their operations. It encompasses a range of comprehensive, holistic actions that should be guided by a shared vision and unified strategy. Digitization initiatives are diverse, and technologies and market requirements are rapidly evolving. The identified phenomena associated with implementing digital transformation call for a strategic and operational approach. Implementing and sustaining digitization efforts in hospitals, through the gradual

adoption of innovative solutions and new technologies, call for access to high-quality, educated, and skilled medical and administrative personnel.

The digitization of medical services is strongly rooted in the concept of the so-called information society. On the one hand, it aligns with its fundamental principles, and on the other hand, it constitutes an essential part of it. It is a significant area for interventions within the development of the information society, enabling social integration, improved medical services, and a higher quality of life. It is one of the ways to ensure the reliability and security of network infrastructure, as well as effective management and maintenance of this infrastructure.

Digital solutions bring about comprehensive modernization of healthcare services, and with the advancement of digital technologies, it can be presumed that the cost of medical services will decrease while their availability and utilization will increase. Digitization contributes to strengthening the healthcare system, supporting the resolution of contemporary issues by enhancing the efficiency of the treatment process and promoting disease prevention and health promotion in an aging society.

The analyses conducted in this article are limited by the scope of the research. Such results are a major impediment to more complex and in-depth analyses, as it is difficult here to adopt normative limits for the range of values for individual evaluation criteria - the results of the research depend on the specifics of the entities included in the research sample. The degree of digitization of the health sector may also vary between voivodeships.

Undoubtedly, conducted research has demonstrated the importance and fascinating nature of this subject, which should continue to be explored. Further research areas should focus on the utilization of telemedicine solutions and artificial intelligence tools in healthcare.

Acknowledgements

The paper financed by the Faculty of Security, Logistics and Management of the Military University of Technology, grant in the discipline of management and quality studies.

References

1. Davis, A.M., Sampilo, M., Gallagher, K.S. et al. (2016). Treating rural paediatric obesity through telemedicine vs. telephone: Outcomes from a cluster randomized controlled trial. *Journal of Telemedicine and Telecare*, 22(2), pp. 86-95. Doi:10.1177/1357633X15586642.
2. *Future Proofing Healthcare*. Retrieved from: <https://healthcaretransformers.com/healthcare-business/strategy-and-operations/future-proofing-phi/>, p. 14, 12.05.2023.

3. Givertz, M.M., Stevenson, L.W., Costanzo, M.R., Bourge, R.C., Bauman, J.G., Ginn, G. (2017). CHAMPION Trial Investigators. Pulmonary Artery Pressure-Guided Management of Patients With Heart Failure and Reduced Ejection Fraction. *Journal of the American College of Cardiology*, Vol. 70, Iss. 15, pp. 1875-1886. Retrieved from: <https://www.sciencedirect.com/science/article/pii/S0735109717392.483?via%3Dihp>, 12.05.2023.
4. Liao, Y., Deschamps, F., de Freitas Rocha Loures, E., Pierin Ramos, L.F. (2017). Past, present and future of Industry 4.0 – a systematic literature review and research agenda proposal. *International Journal of Production Research*, 55(12).
5. Matt, C., Hess, T., Benlian, A. (2015). Digital Transformation Strategies. *Business and Information Systems Engineering*, 57(5).
6. Parida, V. (2018). *Adressing Societal Challenges*. Lulea: Sweden: Lulea University of Technology.
7. Pieriegud, J., Paprocki, W., Zawieska, J. (2016). *Cyfryzacja gospodarki i społeczeństwa: szanse i wyzwania dla sektorów infrastrukturalnych*. Gdańsk: Instytut Badań nad Gospodarką Rynkową – Gdańska Akademia Bankowa.
8. Poliński, J., Ochociński, K. (2020). Cyfryzacja w transporcie kolejowym. *Problemy kolejnictwa*, z. 188 (wrzesień 2020). DOI: 10.36137/1885P.
9. *Program Rozwoju E-Zdrowia w Polsce na lata 2022-2027*. Ministerstwo Zdrowia. Retrieved from: <https://www.gov.pl/web/zdrowie/program-rozwoju-e-zdrowia-na-lata-2022-2027>, 12.05.2023.
10. *Raport: System ochrony zdrowia w Polsce – stan obecny i pożądane kierunki zmian*. Retrieved from: <https://www.nik.gov.pl/plik/id,20223,vp,22913.pdf>, 12.05.2023.
11. REGULATION (EU) 2021/522 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 March 2021 establishing a Programme for the Union's action in the field of health ('EU4Health Programme') for the period 2021-2027, and repealing Regulation (EU) No 282/2014. Retrieved from: <https://eur-ex.europa.eu/eli/reg/2021/522/oj>, 12.05.2023.
12. Schmier, J.K., Ong, K.L., Fonarow, G.C. (2017). Cost-Effectiveness of Remote Cardiac Monitoring With the CardioMEMS Heart Failure System. *Clinical Cardiology*, pp. 430-436. Retrieved from: <https://doi.org/10.1002/clc.22696>, 12.05.2023.
13. Schütte, S., Acevedo P.N.-M., Flahault, A. (2018). Health systems around the world - a comparison of existing health system rankings. *Journal of Glob Health*, Jun 8(1), 010407. doi: 10.7189/jogh.08.010407. PMID: 29564084; PMCID: PMC5857204. Retrieved from: <https://jogh.org/documents/issue201801/jogh-08-010407.pdf>, 12.05.2023.
14. Śledziwska, K., Włoch R. (2020). *Gospodarka cyfrowa jak nowe technologie zmieniają świat*. Warszawa: Wydawnictwa Uniwersytetu Warszawskiego.

15. *State of Health in the EU Poland Country Health Profile 2021*. Retrieved from: https://health.ec.europa.eu/system/files/2021-12/2021_chp_poland_english.pdf, 12.05.2023.
16. *Study on Digital Health implementation in the EU. Presentation of Digital Health benchmark results* (2022). Retrieved from: <https://ue.esante.gouv.fr/sites/default/files/2022-07/Presentation%20of%20the%20study%20on%20digital%20health%20in%20the%20EU%20carried%20out%20by%20the%20French%20Ministry%20of%20Health%20and%20Prevention.pdf>, 12.05.2023.
17. Uchwała Nr 738/21 Zarządu Województwa Łódzkiego z dnia 10 sierpnia 2021 r. w sprawie przyjęcia Strategii Polityki Zdrowotnej dla Województwa Łódzkiego na lata 2021-2027.
18. Ustawa z dnia 15 kwietnia 2011 r. o działalności leczniczej, Dz.U. 2011, nr 112, poz. 654.
19. *Vision healthier European Union*. Retrieved from: https://health.ec.europa.eu/funding/eu4health-programme-2021-2027-vision-healthier-european-union_pl, 12.05.2023.
20. Wiktor, J.W., Ďaďo, J., Šimberová, I. (2021). The Digital Transformation of the EU Market. The Digital Single Market Strategy in the Context of E-Commerce Development Diversification in Czechia, Poland and Slovakia. *Problemy Zarządzania*, 19(1).
21. Wysokińska, Z. (2021). Przegląd wpływu transformacji cyfrowej na gospodarkę światową i europejską. *Comparative Economic Research. Central and Eastern Europe*, 24(3).
22. Zimnoch, D. (2021). Digital Transformation of Transportation in the Age of COVID-19. *Problemy Zarządzania*, 19(3).