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Sustainable Digital Transformation in Healthcare: Challenges and Directions in the Society 5.0 Era

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Abstract. This study conducts a comprehensive literature review on the digital transformation required by health service institutions during the Society 5.0 era. Utilizing articles related to digital transformation and health services, the study presents qualitative data simplified into descriptive narratives to draw meaningful conclusions. The method employed is a qualitative literature review. The review identifies significant challenges, including big data utilization, data security, privacy concerns, and the implementation of cloud computing systems. Furthermore, the research synthesizes current trends and proposes actionable recommendations for overcoming these challenges, such as adopting Health 5.0 and fostering integrated Community 5.0 systems. The study underscores the importance of maintaining the human aspect amidst technological advancements. Future research directions are outlined, focusing on the "big data-based society" within Society 5.0 to explore innovative solutions, mitigate barriers, and ensure sustainable digital transformation in healthcare services.

Keywords: digital transformation, health services, era of society 5.0

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1. Introduction

The field of health or hospital services is inseparable from the impact of competition due to globalization, even though the hospital business has differences from other non-health business or industry sectors [1]. Digital transformation is one of the solutions to improve business processes and organizational efficiency by triggering significant changes in its components through the combination of information, computing, communication, and connectivity that utilizes technology [2]. Digital transformation will affect various aspects of the organization such as the use of digital resources, digital

growth strategic design, changes to internal organizational structures, as well as the definition of various measurements for the goals to be achieved [3].
Digital transformation describes advancements in digital technology that are applied to the healthcare industry and society as a whole [4]. Digital technologies must be used by the healthcare system to develop creative ways to enhance healthcare delivery and advance the medical industry [5]. The digital transformation of healthcare encompasses developments connected to the internet, digital technology, and their relationship with new therapies and best practices for better health management procedures[6]. Quality control of the huge data collected can help enhance patient well-being and minimize care costs.[7]. Digital technology is set to influence medical education, prompting experts to develop innovative training methods. Key technologies driving digital transformation include Internet of Things (IoT) platforms, cloud computing, and artificial intelligence [8].

The following is the output of the VOSviewer software which was run from articles for 2019-2023 related to the keywords digital transformation and health services which can be seen on a bibliometric map as follows:

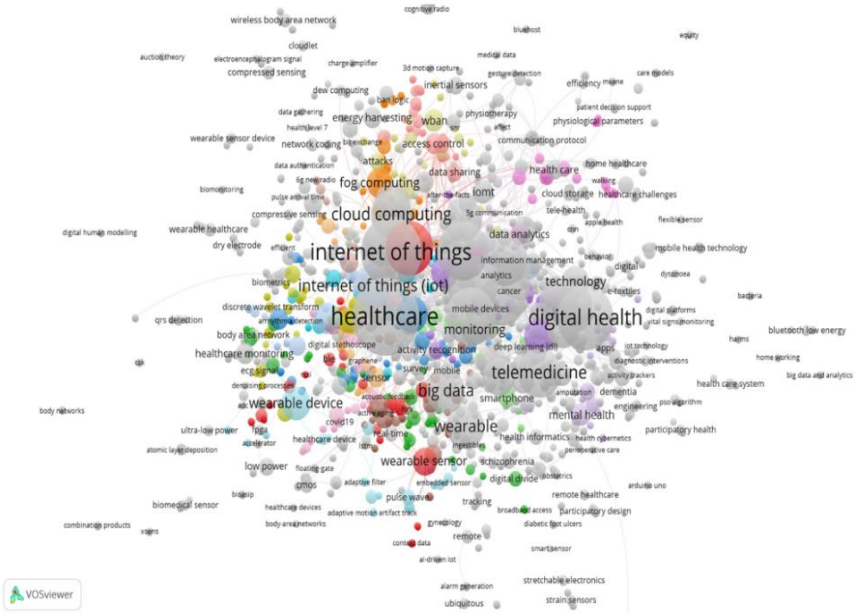

Figure 1. Digital Technology and Healthcare Bibliometric Map Output from Vosviewer Software

Digital transformation in the field of health services in the era of Society 5.0 brings many new opportunities and challenges, where some of the problems that arise include: (1) Data Security and Privacy: there are threats such as data breaches and identity theft, (2) Limited Access: not all individuals or regions have equal access to digital devices and the necessary internet connectivity, (3) Quality of Information: easy access to health information via the internet can lead to the dissemination of inaccurate or even harmful information. (4) Technology Dependence: excessive dependence on technology in healthcare can become a problem if the technology infrastructure is disrupted or fails, (5) Ethics and Responsibilities: the use of technology such as artificial intelligence (AI) and big data analysis (big data) in medicine and diagnosis raises ethical questions regarding decision-making and responsibility if technology gives wrong recommendations, (6) Quality of Service and Patient-Doctor Relationship, digital transformation is not may sacrifice human aspects in health services. It is important to maintain

an empathetic relationship between patient and doctor, even in the use of more sophisticated technology. (6) Regulation and Compliance: Regulations related to the use of technology in health services must be properly regulated to ensure patient safety and compliance with medical standards (6) Service Quality and Patient-Doctor Relations, digital transformation must not sacrifice human aspects in health services. It is important to maintain an empathetic relationship between patient and doctor, even in the use of more sophisticated technology. (6) Regulation and Compliance: Regulations related to the use of technology in health services must be properly regulated to ensure patient safety and compliance with medical standards (6) Service Quality and Patient-Doctor Relations, digital transformation must not sacrifice human aspects in health services. It is important to maintain an empathetic relationship between patient and doctor, even in the use of more sophisticated technology. (6) Regulation and Compliance: Regulations related to the use of technology in health services must be properly regulated to ensure patient safety and compliance with medical standards[9].

The Society 5.0 era represents a paradigm shift from the technology-driven Society 4.0, emphasizing human-centered innovation that integrates cyberspace and physical space to create a super-smart society. Unlike its predecessor, Society 5.0 leverages advanced technologies such as artificial intelligence (AI), big data, and the Internet of Things (IoT) not only to optimize industrial productivity but also to enhance human well-being, sustainability, and social equity. This transition addresses challenges of rapid technological growth while fostering balanced integration between technological advancements and human-centric solutions [10].

2. Literature Review

2.1. Digital Transformation

Digital transformation is a substantial change in an entity with (digital) technology. Digital technologyrefers to a combination of information, computing, communication, and connectivity technology or technology that is new to the entity and its respective objectives of business strategic alignment [10].Digital transformation refers to a process that aims to improve an entity (including business processes, efficiency, and so on) by triggering significant changes in its components through the combination of information, computing, communication, and connectivity that utilizes technology [11].

Digital transformation affects many aspects of the company, such as the acquisition of digital resources, the design of digital growth strategies, changes to internal organizational structures, and the definition of proper metrics and goals [12]. The digital revolution in healthcare is creating new business opportunities and generating new business models to address issues in medical practice, value creation and other issues related to ecosystems including: patients, pharmaceutical companies, hospitals, governments, public agencies and other entities [13].

Many industries, particularly the health industry, have undergone radical change as a result of digital transformation. A person can live a longer, healthier, and more productive life thanks to technology in the health industry [14].

2.2. Era Society 5.0

The Era of Society 5.0 is an era where all technology becomes part of humans themselves. The internet is not just for sharing information but for living life. In Society 5.0, new values and lifestyles created through technological developments can minimize the existence of inequalities in humans and economic problems in the future [15]. Society 5.0 can be said as a development to fix some of the problems that are currently being faced due to the rapid development of technology. Everything will be easier with the use of Artificial Intelligence (AI) which will help process data so that users receive ready-made results [16]. Physical limitations will also be assisted by robots that are easy to control with

computers and the internet. In short, all life will become completely practical and automatic. In Era Society 5.0 creates a new pattern of order in people's lives. Society as a smart ecosystem [17]. The influence of technology and cyber has changed the mindset of people. Society 5.0 teaches humans to be able to integrate life between the virtual world and the physical world in a good and balanced manner, so that there will be harmony towards improving human life [18].

In Era Society 5.0, a large amount of information from sensors in physical space is accumulated in cyberspace. In cyberspace, this big data is analyzed by artificial intelligence (AI), and the results of the analysis are fed back to humans in physical space in various forms [19]. Several technological transformations that can be implemented in Era Society 5.0 include web-based software (e-health); smartphone applications (m-Health), text messaging applications, and wearable devices; health information technology; telehealth or telemedicine; electronic medical record (EMR); and advanced uses of computational science in big data, genomics, and artificial intelligence [20].

Figure 2. Monitoring device for blood glucose levels with a smartphone,
Smartwatch to record patient's blood pressure,
EKG using a smartphone

2.3. Digital Transformation in Health Services

Digital technologyNow that it has been developed and applied to every aspect of health and health services, various digital medical devices can be implemented in an application. Digital transformation can provide effective and efficient benefits related to patient diagnosis needs, improving care for chronic patients. Diagnostic tools that have been enhanced include: smartphone-based photoplethysmography where smartphone cameras can record videos of subjects based on artificial intelligence (AI) in detecting diabetes [21]. Artificial intelligence is also used in radiology and pathology to augment diagnostic human interpretation (eg, ocular, x-ray, or magnetic resonance imaging) and pathology slides. In drug-related research and manufacturers also utilize various forms of artificial intelligence in recruiting patients, using virtual technology and using technology to detect and purify pharmaceutical targets [22]. Today's digital technologies have been developed and applied to every aspect of health and healthcare. The potential for digital innovation in health care delivery includes: advancing diagnosis and treatment, ensuring continuity of care, facilitating off-site patient management through telemedicine, partnering with individuals to support self-management, and reducing errors and waste in delivery systems [23]. which is shown in the following figure:

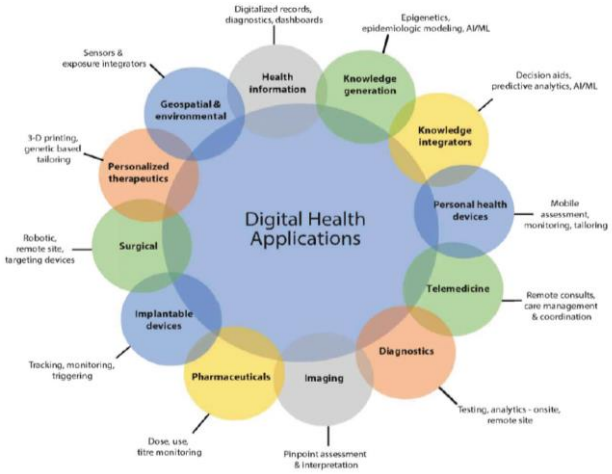

Figure 3. Growing Digital Technology Applications in Health and Health Care[19]

3. Methods

This study employs a literature review approach to examine digital transformation in healthcare services during the Society 5.0 era. The methodology includes clearly defined inclusion and exclusion criteria, a systematic process for data collection, and rigorous analysis techniques to ensure the reliability and relevance of the findings. This study uses a literature review study by searching articles related to digital transformation and health services with the following stages: testing the quality of studies, collecting and characterizing data, analysis, interpretation of results, and recommendations and further research. Of the several journal publications that were searched for which were used for literature review, there were 7 national journals and 24 international journals. The selected articles were analyzed using a thematic analysis approach. Key themes were identified, including innovations, challenges, and opportunities related to healthcare transformation in the Society 5.0 era. Data was synthesized into a narrative framework to provide a comprehensive understanding of the topic.

4. Result and Discussion

The findings of this study highlight the significant role of digital transformation in reshaping the healthcare sector, particularly in the Society 5.0 era. This section expands on the implications for various stakeholders, examines potential impacts on healthcare policies and management practices, and provides an in-depth analysis of the practical and theoretical implications of the results. The various research collected converged into 31 articles which can be summarized in relation to the data analysis techniques used to discussdigital transformation in the field of health services in the Era of Society 5.0.The following is a summary of the results of the research review literature summarized in the following description.

Table 1. Summary Literacy deals withdigital transformation
In the Field of Health Services in the Era of Society 5.0

No.	Name of Researcher and Year	Research Purposes	Data analysis technique
1.	Budiyanto, 2022	Describe the digital transformation in patient-centric healthcare	*Observational descriptive analysis*
2.	Laksono & Darmawan 2021	Explainto explore digital information and leadership roles in future healthcare.	*Literature review*
3.	Purwaningrum & Madrah, 2019	Review and deepen health services in the digital era.	*Literature review*
4.	Julianti et al, 2022	To find out how to implement digital marketing strategies in hospitals.	*Literature review*
5.	Andreanto & Handayani, 2022	To describe public health services through the use of digital technology in the era of society 5.0	*Literature review*
6.	Subawa et al., 2021	To examine efforts that can be made as a solution to overcome the limitations of health facilities as well as the use of existing technology to support the realization of maternal and child health.	*Literature review*
7.	Putri et al., 2022	To find out and analyze the use of information technology in the form of applications for online dental consultations among generation Z	Descriptive quantitative analysis
8.	Jason, 2022	Examining how factors related to digital transformation and the standard of healthcare in the Age of Disruption and Society interact 5.0.	*Literature review*
9.	Natakusumah et al., 2022	To describe the digital transformation of quality service health in industrial healthcare during the disruption and Society 5.0 era	*descriptive analysis*
10.	Teixeira et al., 2023	To reflect on the challenges of health information systems in Portugal at a time when technology is enabling new approaches and models of care delivery, and to identify scenarios that might characterize this practice in the future	*Qualitative analysis with interviews*
11.	Stoumpos et al., 2023	To analyze changes that occur in the health sector due to digital transformation.	*Literature review*
12.	Lina, 2023	To assess the existing literature on the digital transformation of healthcare in the digital economy.	*Literature review*
13.	Kraus et al., 2021	To analyze the digital transformation of the healthcare sector from the latest research	*Systematic Literature review*
14.	Pete et al., 2023	To describe a literature review related to digital health innovations in the care of cancer patients	*descriptive analysis*
15.	Hermes et al., 2020	To describe and explore research related to digital transformation in the healthcare industry and explore	*Literature review*

		the rise of emerging platform ecosystems and their impact on the role of patients	
16.	Marwaha et al., 2023	To describe digital transformation in patient surgery	*descriptive analysis*
17.	Ossebard & Van Gemert-Pijnen, 2016	To describe eHealth and healthcare quality	*descriptive analysis*
18.	Verhoef et al., 2021	To identify and describe growth strategies for digital companies as well as assets and capabilities for digital transformation	*Literature review*
19.	Albertethy et al., 2022	To describe the current and future digital transformation in the health sector	*descriptive analysis*
20.	Muhajir et al., 2022	Describe implementation, identify determinants and strategies for digital transformation. The method used is a qualitative approach with informants from structural officials, installation heads, staff, and patients	*descriptive analysis*
21.	Iyanna et al., 2022	To identify perceived barriers and other inhibiting factors that impede the adoption and sustainable use of e-health innovations.	*Qualitative analysis with a questionnaire*
22.	Fragão-Marques & Ozben, 2023	To describe the role of digital transformation in the healthcare and clinical laboratory fields	*descriptive analysis*
23.	Konopic & Blunk, 2023	This study aims to examine the impact of digital transformation on the healthcare sector. This is achieved by providing a conceptual model of the healthcare sector in digital transformation.	*Systematic literature review*
24.	Casprini & Palumbo, 2022	Describe the benefits of digital transformation through government-private collaboration in the healthcare ecosystem	*descriptive analysis*
25.	Zhou et al., 2022	To examine the factors that influence the sustainability of digital transformation in health services	*Mix Methods*
26.	Al Kahtani et al., 2022	To measure the digital transformation readiness of the healthcare sector in support of people, predictive analytics, governance and workforce, and interoperability in hospitals in Saudi Arabia.	*Cross sectional design*with a questionnaire
27.	Kurniasih et al., 2022	This study aims to examine how digital transformation impacts service quality in the healthcare industry within the context of disruption and Society 5.0.	*Literature review*
28.	Nikiforova et al., 2023	To find out what key factors must be met and achieve the benefits of digital transformation in the era of society 5.0	*descriptive analysis*
29.	Herman et al., 2018	To identify what types of technology enablers, business models, and value networks are likely to emerge from different groups of innovators in relation to digital transformation efforts in healthcare	*descriptive analysis*

30.	Cristofaro et al., 2020	To evaluate the overall performance of digital transformation in increasing excellence in the pharmaceutical sector as a health service unit in hospitals	*Literature review*
31.	Akinola & Telukdarie, 2023	To identify key focus areas for AI and healthcare technology innovation, benefits, challenges, best practices, sustainable approaches, and impact on patient outcomes	*Systematic literature review*

Source : Several journal articles, 2023

4.1 Discussion

Digital transformation and innovation represent a fundamental shift in the industry, encompassing business models influenced by the adoption of digital technologies, such as the digitization of products, services, and processes. Examples of digital health solutions include electronic health (eHealth), mobile health (mHealth), health information technology, and teleconsultation services like telehealth or telemedicine [24].

The application of digital technologies in healthcare services can be aimed at reducing problems that often occur in their services, complaints often occur due to the long time it takes for prospective patients to register for a medical test, there are also complaints about knowledge of the tests to be carried out by patients, it is not uncommon for patients to cancel the test that will be passed because of this, and will result in a delay in the test time. By utilizing digital technology, it will not only save time, but also reduce patient mobility to take or find out the results of medical tests [25].

To achieve effective data integration on a national level, hospitals, as health service institutions, must be encouraged to quickly adopt digital transformation in their management. One of the issues that is difficult to comprehend and implement in business is the usage of big data, data security and protection, data privacy, and cloud computing systems [26].

Hospitals need to be immediately motivated to apply information technology in their management in an orderly manner to realize optimal data integration on a national scale. The problem of using big data, data security and protection, data privacy, and the use of cloud computing systems is also one of the issues that is quite challenging to understand and apply to business. Various recommendations related to the parties have been formulated in focus group discussions [27].

Digital transformation has revolutionized several industries, especially the health sector. Technological advancements in healthcare empower individuals to live healthier lives, extend their lifespan, and enhance their productivity [28]. As the era of disruption 4.0 approaches, numerous hospitals and healthcare facilities continue to encounter significant challenges. Key issues stem from unclear laws and regulations, as well as a lack of coordination among relevant ministries. Internally, obstacles such as limited transparency, insufficient motivation, and inadequate knowledge management among hospital administrators, medical professionals, and IT teams also require attention [29].

When society is in the Society 5.0 era, there is a shift from an information society to a super smart society or an imagination society. The current trend of openness shows that the principle of openness should be followed not only by data but also research, education, software, standards, hardware, etc. The principle of openness should be a philosophy to be followed at different levels, in different domains. This should guarantee greater transparency, close disparities, promote and achieve sustainable development goals [30]. Therefore, many agendas now have transparency as a prerequisite. This chapter discusses the concepts of open data (government) and Society 5.0 demonstrating common goals,

provides some success stories of using open data in smart cities or transforming cities into smart cities, and maps them to the features of Society 5.0 [31].

Digital transformation necessitates a shift in healthcare policies and management approaches: Policy Innovation : policies must evolve to address the complexities of data sharing, cross-border health data exchange, and AI-driven decision-making. Transparent and robust regulatory frameworks are essential for fostering trust among stakeholders. Healthcare Management: Hospital management practices must adapt to incorporate data-driven decision-making, optimize resource allocation, and integrate cloud-based systems for seamless operations. For instance, predictive analytics can enhance capacity planning, while AI can support real-time monitoring and early intervention in critical cases.

While the potential benefits are significant, the study identifies several challenges, including: Ensuring data security and privacy amid increasing cyber threats, Addressing ethical concerns in AI-driven decision-making and bridging the gap between technological advancements and human-centric care.

5. Conclusion

The Society 5.0 era represents a transformative phase in healthcare, where digital technologies such as AI, IoT, and big data are integrated to improve efficiency, accessibility, and outcomes. This study highlights the pivotal role of digital transformation in healthcare services, addressing key challenges and identifying actionable recommendations for stakeholders. Hospitals and healthcare providers must adopt comprehensive digital strategies to ensure seamless data integration, maintain patient-centric care, and leverage technology for improved operational efficiency.

As health service organizations, hospitals must be encouraged to start implementing digital transformation in their management right away in order to achieve the best possible data integration across the country. employing big data, protecting and securing data, protecting privacy, and employing cloud computing platforms are all issues that are difficult for businesses to comprehend and handle.

6. Suggestions and Recommendations

Some suggestions from the results of literacy studies related to digital transformation in health services include:

1. Digital transformation has the potential to evolve into Health 5.0, forming part of an integrated Community 5.0. Future advancements in digital health can enhance the efficiency of medical services, while still requiring human involvement.
2. Future research needs to examine the "big data-based society" in the era of Society 5.0 in identifying the role of openness in promoting Smart Societies, Smart Cities, and Human-centered Smart Living.

Future research should focus on the following specific areas to further enhance the understanding and application of digital transformation in healthcare: Ethical and Legal Implications of AI in Healthcare, Equitable Access to Digital Health Solutions, Interoperability and Data Standardization, Human-Centric AI Applications, Big Data Utilization in Predictive Healthcare, Policy and Governance for Digital Health and Impact of Digital Health on Health Outcomes.

Reference

[1] K. C. Budiyatno, P. Pascasarjana, K. Administrasi, R. Sakit, and D. Administrasi, “refrensi jurnal bisnis digital permasalahan 5547-21136-2-PB (1),” vol. 8, no. 2, pp. 66–73, 2022.

[2] E. Surya Darmawan and S. Laksono, “The New Leadership Paradigm in Digital Health and Its Relations to Hospital Services,” *J. Ilmu Kesehat. Masy.*, vol. 12, no. 2, pp. 89–103, 2021, doi:

10.26553/jikm.2021.12.2.89-103.

[3] A. R. Purwaningrum and M. Y. Madrah, "Digitalisasi Layanan Kesehatan dalam Perspektif Islam," *Conf. Islam. Stud. 2019*, pp. 231–244, 2019.

[4] V. S. Julianti, A. C. Sjaaf, and W. Sulistiadi, "Strategi Implementasi Digital Marketing di Rumah Sakit pada Masa Pandemi COVID-19," *Mppki*, vol. 5, no. 3, pp. 56–61, 2022.

[5] D. D. Andreanto and A. N. Handayani, "Pelayanan Kesehatan Masyarakat Melalui Pemanfaatan Teknologi Digital Society 5.0," *J. Inov. Tek. dan Edukasi Teknol.*, vol. 2, no. 5, pp. 220–223, 2022.

[6] Subawa, I. A. K. Pujayani, N. P. A. C. D. K. P. Astuti, and Y. Triliany, "Strategi Pemanfaatan Telemedicine Sebagai Upaya Untuk Mendukung Kesehatan Ibu Dan Anak," *Semin. Nas. Dies Natalis Ke-42 Univ. Tunas Pembang. Surakarta*, pp. 18–25, 2021.

[7] Ansori, "Pemanfaatan teknologi informasi dalam bentuk aplikasi untuk konsultasi gigi secara online (teledentistry) di kalangan generasi Z pada era society 5.0," *Pros. Webinar Nas. Pekan Ilm. Pelajar*, vol. 4, no. Januari, pp. 593–602, 2022.

[8] M. Jasin, "Digital Transformation of Health Quality Services in The Healthcare Industry During Disruption and Society 5.0 Era : A Literature Review," *J. Posit. Sch. Psychol.*, vol. 6, no. 5, pp. 7431–7436, 2022, doi: 10.3389/fpubh.2022.971486.

[9] K. Natakusumah, E. Maulina, A. Muftiadi, and M. Purnomo, "Digital Transformation of Health Quality Services in The Healthcare Industry During Disruption and Society 5.0 Era," *Front. Public Heal.*, vol. 10, pp. 1–3, 2022, doi: 10.3389/fpubh.2022.971486.

[10] L. Teixeira, I. Cardoso, J. Oliveira e Sá, and F. Madeira, "Are Health Information Systems Ready for the Digital Transformation in Portugal? Challenges and Future Perspectives," *Healthc.*, vol. 11, no. 5, 2023, doi: 10.3390/healthcare11050712.

[11] A. I. Stoumpos, F. Kitsios, and M. A. Talias, "Digital Transformation in Healthcare: Technology Acceptance and Its Applications," *Int. J. Environ. Res. Public Health*, vol. 20, no. 4, 2023, doi: 10.3390/ijerph20043407.

[12] M. Cabanillas-Carbonell, J. Pérez-Martínez, and J. A. Yáñez, "5G Technology in the Digital Transformation of Healthcare, a Systematic Review," *Sustain.*, vol. 15, no. 4, pp. 127–132, 2023, doi: 10.3390/su15043178.

[13] S. Kraus, F. Schiavone, A. Pluzhnikova, and A. C. Invernizzi, "Digital transformation in healthcare: Analyzing the current state-of-research," *J. Bus. Res.*, vol. 123, pp. 557–567, 2021, doi: 10.1016/j.jbusres.2020.10.030.

[14] S. Patel *et al.*, "Advancing Digital Health Innovation in Oncology: Priorities for High-Value Digital Transformation in Cancer Care," *J. Med. Internet Res.*, vol. 25, pp. 1–8, 2023, doi: 10.2196/43404.

[15] S. Hermes, T. Riasanow, E. K. Clemons, M. Böhm, and H. Krcmar, "The Digital Transformation

of The Healthcare Industry: Exploring The Rise of Emerging Platform Ecosystems and Their Influence on The Role of Patients," *Bus. Res.*, vol. 13, no. 3, pp. 1033–1069, 2020, doi: 10.1007/s40685-020-00125-x.

[16] J. S. Marwaha, M. M. Raza, and J. C. Kvedar, "The digital transformation of surgery," *npj Digit. Med.*, vol. 6, no. 1, pp. 10–12, 2023, doi: 10.1038/s41746-023-00846-3.

[17] H. C. Ossebaard and L. Van Gemert-Pijnen, "EHealth and quality in health care: Implementation time," *Int. J. Qual. Heal. Care*, vol. 28, no. 3, pp. 415–419, 2016, doi: 10.1093/intqhc/mzw032.

[18] P. C. Verhoef *et al.*, "Digital transformation: A multidisciplinary reflection and research agenda," *J. Bus. Res.*, vol. 122, no. September 2019, pp. 889–901, 2021, doi: 10.1016/j.jbusres.2019.09.022.

[19] A. Abernethy, L. Adams, M. Barrett, C. Bechtel, and P. Brennan, "The Promise of Digital Health: Then, Now, and the Future," *NAM Perspect.*, no. June, pp. 1–24, 2022.

[20] Muhajir Muhajir, Haedar Akib, and Risma Niswaty, "Digital Transformation at Regional General Hospitals of Prof. dr. H.M. Anwar Makkatutu, Bantaeng Regency," *Proceeding Int. Conf. Econ. Bus.*, vol. 1, no. 2, pp. 508–522, 2022, doi: 10.55606/iceb.v1i2.211.

[21] S. Iyanna, P. Kaur, P. Ractham, S. Talwar, and A. K. M. Najmul Islam, "Digital Transformation of Healthcare Sector. What is Impeding Adoption and Continued Usage of Technology-Driven Innovations by End-Users?," *J. Bus. Res.*, vol. 153, no. February, pp. 150–161, 2022, doi: 10.1016/j.jbusres.2022.08.007.

[22] M. Fragão-Marques and T. Ozben, "Digital transformation and sustainability in healthcare and clinical laboratories," *Clin. Chem. Lab. Med.*, vol. 61, no. 4, pp. 627–633, 2023, doi: 10.1515/cclm-2022-1092.

[23] J. Konopik and D. Blunck, "Development of an Evidence-Based Conceptual Model of the Health Care Sector Under Digital Transformation: Integrative Review," *J. Med. Internet Res.*, vol. 25, 2023, doi: 10.2196/41512.

[24] E. Casprini and R. Palumbo, "Reaping the benefits of digital transformation through Public-Private Partnership: A service ecosystem view applied to healthcare," *Glob. Public Policy Gov.*, vol. 2, no. 4, pp. 453–476, 2022, doi: 10.1007/s43508-022-00056-9.

[25] S. Zhou, Z. Ni, A. Ogihara, and X. Wang, "Sustainable Transformation of Digital Health Services- A Stakeholder Exploratory Case Study," *Prepr. J.*, no. May, pp. 1–23, 2022, doi: 10.20944/preprints202205.0061.v1.

[26] N. Al-Kahtani *et al.*, "Digital Health Transformation in Saudi Arabia: A Cross-Sectional Analysis Using Healthcare Information and Management Systems Society' Digital Health Indicators," *Digit. Heal.*, vol. 8, pp. 1–9, 2022, doi: 10.1177/20552076221117742.

[27] D. Kurniasih, P. I. Setyoko, and A. S. Saputra, "Digital Transformation of Health Quality Services in The Healthcare Industry During Disruption and Society 5.0 Era," *Front. Public Heal.*, vol. 10, no. 5, pp. 139–143, 2022, doi: 10.3389/fpubh.2022.971486.

[28] A. Nikiforova, M. A. A. Flores, and M. D. Lytras, “The Role of Open Data in Transforming the Society to Society 5.0: A Resource or a Tool for SDG-Compliant Smart Living?,” *Smart Cities Digit. Transform. Empower. Communities, Limitless Innov. Sustain. Dev. Next Gener.*, pp. 219–252, 2023, doi: 10.1108/978-1-80455-994-920231011.

[29] M. Herrmann, P. Boehme, T. Mondritzki, J. P. Ehlers, S. Kavadias, and H. Truebel, “Digital Transformation and Disruption of The Health Care Sector: Internet-Based Observational Study,” *J. Med. Internet Res.*, vol. 20, no. 3, pp. 1–8, 2018, doi: 10.2196/jmir.9498.

[30] C. L. Cristofaro, M. Ventura, T. A. Rita, R. Reina, and A. De Francesco, “Measuring healthcare performance in digitalization era : the Pharmacy Unit of Academic Hospital,” *Impresa Progett. - Electron. J. Manag.*, vol. 2, no. April, pp. 1–20, 2020, doi: 10.15167/1824.

[31] S. Akinola and A. Telukdarie, “Sustainable Digital Transformation in Healthcare: Advancing a Digital Vascular Health Innovation Solution,” *Sustainability*, vol. 15, no. 13, p. 10417, 2023, doi: 10.3390/su151310417.