



DIGITAL MODELS AND ENGINEERING ARCHITECTURE OF QUALITY MANAGEMENT SYSTEMS IN HEALTHCARE: INTERNATIONAL MEDTECH PRACTICES

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A B S T R A C T

The research examines the problem of the weak technical component in the digital model of healthcare quality management applied in developing countries. It provides a comparative maturity assessment of digital healthcare quality systems. As an original solution, it proposes supplementing this model with a new component: industrial and manufacturing engineering for MedTech. The research considers digital models of healthcare quality management through the lens of the engineering organization of medical services and MedTech infrastructure. The research demonstrates that improvements in the quality of healthcare are achieved not through individual digital services, but through a comprehensive architecture that includes electronic health records, telemedicine platforms, mobile solutions, digital data exchange channels, and analytical decision-support tools. Particular attention is paid to a comparative analysis of countries with highly digitalized healthcare systems, where the quality of medical services is supported through a combination of government platforms, private technological solutions, and a standardized regulatory environment. The practical significance of the research lies in the possibility of adapting the identified models to the design of national and regional digital healthcare platforms. The architecture of digital healthcare systems, including electronic health records, telemedicine platforms, and remote monitoring systems, is examined with regard to the distribution of functions among subsystems, data flows, and reliability parameters. Simple quantitative estimates of system response time, failure frequency, and service availability are provided and interpreted as operational characteristics of the MedTech engineering infrastructure.



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1. INTRODUCTION

The digitalization of healthcare has ceased to be merely a supporting area of modernization and has evolved into an independent mechanism for managing the quality of medical care. Whereas in the traditional model, the primary burden was placed on physical infrastructure and the local competencies of healthcare personnel, in the digital model, outcomes are increasingly determined by the quality of platform-based solutions, the reliability of data exchange, and the capacity to provide patients with remote support.

From an engineering perspective, modern healthcare should be regarded as a distributed system in which electronic health records, telemedicine, mobile applications, diagnostic algorithms, and digital communication channels form an integrated quality framework. This contributes to an increase in the share of users of digital healthcare services, a reduction in patient routing time, and broader telemedicine coverage.

Industrial and manufacturing engineering is critically important for the successful implementation of digital technologies in any technical processes, as well as for ensuring their highly efficient and uninterrupted use on a continuous basis. High-technology medicine (MedTech) is among the priority areas of digital development and therefore requires enhanced engineering and technical support.

However, current practice in developing countries reveals the problem of insufficient engineering and technical support for MedTech, which poses a threat to quality and represents a serious weakness of the digital healthcare quality management model implemented in these countries. The underlying cause of this problem is the inadequate attention paid to the technical component of the digital healthcare quality management model used in developing countries.

The primary efforts within the established model are directed toward the timely implementation of a strict plan for the diffusion of digital technologies, reporting on progress in implementing this plan, and the cost-efficient use of funds allocated from national government budgets for MedTech development. At the same time, quality management is reduced to improving the technical equipment of healthcare systems; however, without adequate engineering and technical maintenance, the installed digital technologies inevitably experience failures, which adversely affect quality.

In the age of digitalization, healthcare is notable for innovative solutions that ensure improvement of the quality and contribute to coverage of the population that previously did not have the necessary access to medical services. Digital technologies in this social sector allow public authorities and subjects of the healthcare system to achieve the goal of sustainable development in the

sphere of social well-being and good health. Remoteness of location, problems with mobility, lack of medical personnel, and busy schedules of patients do not allow them to find time to make appointments with medical specialists or visit them. This is just a part of the problems, which, before the dissemination of digital models of the healthcare system, were an obstacle to the receipt of the required medical help, consultations, or various types of services. Innovations in the sphere of medicine and digitalization became a driving force for the creation of new forms of medical services; they also led to the formation of new infrastructural objects necessary for satisfying demand from the population.

Effectiveness of the influence of digital technological solutions on population's satisfaction, as the systemic indicator of progress, is manifested in the intensity of population's use of digital platforms of healthcare establishments and in the improvement of population's health. Some countries have been able to ensure digital transformation in such aspects as electronic appointments to doctors or electronic health records (Kitsios et al., 2023).

Some countries have reached significant results in the digital transformation of healthcare at the national level; their experience has become an example for other countries. At present, developed and quickly developing countries effectively use various digital technologies in the management of healthcare systems and infrastructure objects. Although the market of digital technological solutions for medicine grows constantly, there are still problematic aspects of their implementation, which affect the quality of medical services. Thus, it is necessary to study these problems and the issue of digitalization of healthcare.

The goal of this research is to identify the types of digital models of quality management in healthcare used in best international practice, distinguishing among these types based on the criterion of industrial and manufacturing engineering for quality. We identify countries that have implemented effective digital healthcare quality management systems and examine the key advantages and challenges associated with adapting these models in other countries, with enhanced support for quality management through the advanced capabilities of industrial and manufacturing engineering. Based on the experience of the selected countries, we conduct a comparative maturity assessment of digital healthcare quality systems.

2. LITERATURE REVIEW, GAP ANALYSIS, AND RESEARCH QUESTIONS

This research is conceptually grounded in the theoretical foundations of the scientific theory of industrial and manufacturing engineering for digital technologies. According to this theory, the implementation and application of digital technologies must be supported by

comprehensive engineering and technical assistance that ensures the adaptation of these technologies to the specific practices being automated and guarantees their proper operation without failures or technical errors (Kim et al., 2026; Qaiser et al., 2026; Xia et al., 2026).

A review and content analysis of the available literature by Gonzalez-Gonzalez et al. (2026), Ishfaqe et al. (2026), and Kingkaw et al. (2026) on the technological modernization of healthcare, accompanied by its digital automation and leading to the development of MedTech, revealed a gap in the published literature concerning the insufficient attention paid to engineering and technical support for quality. The importance of addressing this gap in the existing literature is explained by the fact that, because of it, the digital healthcare quality management model used in developing countries remains incomplete, as it lacks an engineering and technical component. This prevents the model from operating consistently and reduces its effectiveness.

Scholars' approaches to the issue of digitalization of healthcare vary. Stoumpos et al. (2023) dwelt on the formation of a digital model of healthcare that is based on the course towards the realization of patients' interests. Though researchers indicate that a patient-oriented digital model of healthcare became possible due to the integration of digital technologies into quality management, they do not mention other modern digital models of the analyzed type. Also, the authors systematize scientific studies on digitalization of medicine and note that, at the current stage, there is no universal and justified methodology for digital transformation of the state healthcare system; there are only fragmentary works on the implementation of digital systems of medical establishments' management. Jeon et al. (2025) offer an approach to identifying the model of healthcare digitalization in the context of two equal variables: the interests of citizens and target milestones of the sector's subjects. The scholars support the necessity for fair consideration of the interests and goals of the medical sector.

Chaturvedi et al. (2025) considered the connection between the development of telemedicine and the use of innovative digital solutions – teleconsultation platforms, software with predictive analytics, and diagnostics systems based on AI. Stoumpos et al. (2023) elaborated on certain digital smart solutions connected with medical services management in healthcare establishments. The scholars analyze the pros and cons of chatbot systems (medical assistants) used in healthcare in various countries. Based on the analysis, the scholars developed an optimized digital smart solution (chatbot), based on the architecture of all processes of medical establishments. The scholars indicate that this innovation contributes to an increase in the quality of management, processing, and use of big databases and their application in medical services. Paul et al. (2023) disclosed the advantages of developing countries' transition from

traditional medicine to digital medicine, which include access to medical services for all groups of the population and protection of medical data confidentiality. The researchers note the necessity to solve problems that emerge in the process of digitalization, namely, support for medical personnel in mastering digital medical technologies and a constant search for cyber threats to data. Ivanova et al. (2025) noted that improvement of the quality of medical results in surgery due to the wide application of multifunctional educational robotized platforms, used by practicing doctors and students to enhance or receive practical skills. Choudhary et al. (2025) disclosed the effect of the use of modern smart garments and digital sensors in the treatment of arthritis, manifested in the improvement of the quality of patients' lives. Kushwaha et al. (2025) analyzed the effectiveness of using digital smart solutions based on machine learning, which ensure quick diagnostics of diabetic retinopathy and prevention of undesirable consequences for patients.

A lot of works is devoted to the assessment of the effect of digital transformations in the healthcare system on an increase in the effectiveness of medical services. Krahe et al. (2024) identified positive results of implementing a new digital platform of healthcare in Australia, which include the growth of patients using telemedicine services and other digital solutions. According to the authors, the main factors of positive influence of the improved digital innovative system on accessibility of services and competence of personnel are investments and enhanced digital infrastructure.

Many studies dwell on complex analysis of advantages, problems, and factors of digitalization in the healthcare sector, which influence the sector's functioning and meeting the population's expectations. Maxyutova et al. (2022) showed that the low level of labor resources' incomes reduces the effectiveness of sectoral development and leads to high rates of emigration of skilled personnel. Problems of social well-being, noted by the scholars, are peculiar to the sector of healthcare in developing countries, and their resolution requires a comprehensive approach at the public-private partnership level. According to Isayan and Mayilyan (2022), in developed countries, given high but stable GDP per capita, it is impossible to expect quick improvement of personnel skills within lifelong learning; accordingly, without incentives, it is impossible to support innovative initiatives on the improvement of the quality of work. Developed countries should search for the tools to stimulate personnel for the growth of their competitiveness. Omir et al. (2024) point to the fact that although unpredictable events of the COVID-19 pandemic became a stress test, they had a positive effect on the growth of digital transformation, and, as a result, an increase in many indicators of the quality of medical services by medical establishments.

Khalili et al. (2026), Shafique et al. (2026), and Solaru et al. (2026) indicates a close relationship between the industrial and manufacturing engineering of digital technologies and the quality of the products created with their support, including both goods and services. Despite the extensive body of published literature on the topic, the role of industrial and manufacturing engineering in the digital healthcare quality management model remains unclear. This leads to the research question addressed in this article: “What benefits can the industrial and manufacturing engineering of digital technologies provide for quality in MedTech?”

3. RESEARCH METHODOLOGY

Assessment of digital transformation, which contributes to the improvement of quality management in countries with leading medicine, requires a comprehensive approach. It is necessary to identify the following parameters:

- 1) Structure of the subjects of the management of quality of medical services provision in the conditions of digitalization. This includes the list of all stakeholders: from the government and scientific sectors to companies and establishments in the sector. Here, we evaluate the initiatives and activities of the subjects in the context of achieving strategic tasks for the enhancement of certain aspects of healthcare features that emerged as a result of digital transformation.
- 2) Types of digital tools and digital solutions created and applied in the healthcare sector.
- 3) Effectiveness of digital transformation, assessed through the level of population using digital medical services.

Our approach involves the focus on the analysis of the data of empirical and theoretical studies for the identification of the types of digital models of quality management in healthcare. There are other approaches to the assessment of digital transformation in healthcare, which feature the use of questionnaire methods, SWOT analysis, etc.

We study trends in the digitalization of healthcare as the basis for raising quality management at the systemic national level and in the context of healthcare organizations. We also analyze the problems and advantages of digital models of national healthcare systems, using the factor method. The method of comparison is used to compare the characteristics of the digital models.

To calculate the effects of implementing a digital engineering quality system, a regional healthcare service is considered with the following baseline data:

- Number of telemedicine and in-person consultations per year: $N = 100000$.
- Baseline average time to medical consultation, measured from the patient's initial entry into the

system to contact with a physician: before implementation: $T_{\text{base}} = 48$ hours.

- Share of repeat visits caused by diagnostic errors or insufficient information: before implementation: $R_{\text{base}} = 15\%$ of all cases.
- Share of patients with access to EHRs and digital services (digital accessibility): before implementation: $D_{\text{base}} = 40\%$.

After implementation of the proposed architecture (telemedicine + EHR + CDSS), the following target values are specified for the model:

- Target time to consultation: reduction to $T_{\text{target}} = 24$ hours.
- Target share of repeat visits: reduction to $R_{\text{target}} = 10\%$.
- Target digital accessibility: increase to $D_{\text{target}} = 70\%$.

4. RESULTS

4.1 MedTech and the Benefits of Engineering and Technical Support for Quality in Digital Healthcare

Digital innovations in quality management in healthcare are widely used in many countries. Some countries have better results, and this, among others, allows them to be characterized as countries with a high level of medicine. It is expedient to consider countries that demonstrate a high level of digital support of medical services for all categories of population (this is connected with SDG 3: Good health and well-being).

We studied the ranking of 110 countries with the highest level of healthcare, by the following key factors: government's readiness to manage critical situations (threat of emergence and dissemination of viruses and pandemics; reaction to emergency medical cases); affordability of high-quality medicines and medical products; government's expenditures for healthcare per capita; level of medical personnel's competence; and infrastructure of healthcare. The top 10 countries by quality healthcare are as follows (International Citizens Insurance, 2025):

- Israel (10th position). Leading innovative achievements in the sphere of surgery and treatment due to high qualifications and digital technologies. Healthcare system: domination of the state system, with provision of additional services; medical tourism is very popular.
- Norway (9th position). Accessibility and universal character of medical services in all territories.
- Germany (8th position). Advantages: competence and a high share of practicing doctors per capita; an effective state (covers 92% of the population), and private systems of medical insurance. The government also offers medical insurance that is valid in all countries.

- Netherlands (7th position). Access to medicine for all categories of the population and high-quality medical services.
- Ireland (6th position). Quality of medical services and accessibility for the population.
- Sweden (5th position). High qualification of medical personnel and number of doctors per capita (3.3 per 1,000 patients), access to medicine for all categories of citizens due to the implementation of digital services.
- Canada (4th position). High mobility of the healthcare system in each province, quick reaction to emergency medical situations, general access to medical services, free medicine for citizens and residents.
- Australia (3rd position). Access to healthcare services for all categories of the population and a developed infrastructure of medical establishments across the country.
- South Korea (2nd position). Effective medical insurance and leading digital medical technologies. Partially free medical services (20% is covered by the patient) and effective medical insurance (mandatory state insurance and voluntary insurance).
- Taiwan (1st position). Full coverage of medical expenditures and the ubiquitous prevention of diseases.
- The above advantages of the leading countries in healthcare are largely connected with the use of digital models of quality management. Let us consider a digital model of quality management in healthcare in some of the above countries. Table 1 demonstrates the specifics of industrial and manufacturing engineering in the digital model in South Korea

Table 1. Structure of the industrial and manufacturing engineering aspects of the digital model of quality management in healthcare in South Korea

Industrial and manufacturing engineering aspects of the digital model	Analog of traditional medicine	Effectiveness of digital transformation reflecting the benefits of industrial and manufacturing engineering of digital technologies for MedTech quality
1. Electronic health records (EHRs)	Medical records of patients in medical establishments (traditional before 2000 and digital after 2000)	Implementation of Electronic Health Records (EHRs) started in 2022 based on the national unified digital platform. This measure provides access to patients' data (upon their consent) for any medical establishment. It is integrated with all digital sub-structures of the healthcare system (remote monitoring and telemedicine).
2. Hospital digitalization systems	Traditional ways before 2000, and computerization after 2000	Digitalization included the use of complex electronic systems of clinical image management, own electronic records of patients, and Electronic health records (EHRs). The leading hospitals and medical centers independently develop the systems of this type (example: BESTCare 2.0, developed by Seoul National University Bundang Hospital (SNUBH)). In 2024, this system was used by around 50% of all hospitals in South Korea. The system's advantage lies in patient orientation and patients' satisfaction with their interaction with hospitals.
3. Digital medical information technologies	Medical technologies without digital platforms	Uses in global sectoral projects in healthcare: The Korean Health Insurance Review & Assessment Service (HIRA), FeederNet (national system of regular update of data on patients' medical indicators), system of data protection, the project Digital New Deal (digital platform offering smart infrastructure of medical services), etc.
4. Mobile health	No analogs were previously used.	Digital diagnostics and AI tools for care for low-mobile people, digital therapy
5. Telemedicine and teleconsultation	No analogues	From the start of digitalization and until 2020, telemedicine was used in the doctor-doctor form; since 2020, the doctor-patient form has become popular. All procedures are regulated by the law. Teleconsultation is permitted by South Korean law.

Source: Compiled by the authors based on (Springer Nature Limited, 2025; The International Comparative Legal Guides, 2025)

Telemedicine and teleconsultation are gaining popularity in South Korea under the influence of such factors as experience in their use and the age and state of health. The greatest demand for these digital medical solutions (as of late 2024) was observed with the population aged 20-30 and 60-69 (Jeon et al., 2025).

The modern digital model of quality management in healthcare in South Korea can be defined as sustainable and fair, oriented towards the interests and needs of the population, as well as the medical priorities of the healthcare sector's infrastructure (table 2).

Table 2. Telemedicine market in South Korea in 2023–2029

	Data on the telemedicine market	Values
1	Market revenue, \$ billion	2023 – \$1.84 billion, 2024 – \$2.28 billion, 2030 (forecast) - \$6.57 billion
2	Key operators of telemedicine in South Korea	Zoom Video Communications Inc. (USA), Teladoc Health Inc. (USA), Twilio Inc. (USA)
3	Share of South Korea's market revenue in the global revenue, %	2023 – 1.6%

Source: Compiled by the authors based on Grand View Research, Inc. (2025)

The main elements of industrial and manufacturing engineering of the digitalization of Australia's healthcare system are as follows.

1) Digital transformation. Australia has a high level of medical services, leading digital solutions are used, and the country has many institutes and a diverse digital healthcare infrastructure. The wide use of digital technologies in medicine began in 2019, and the COVID-19 crisis in 2020 gave an impetus for their intensive application. A special role among the directions of digital healthcare in Australia belongs to telemedicine, which has been demonstrating quick growth since 2020, when the need for remote medical services became especially relevant. In 2025, the process of digitalization and improvement of systemic implementation of digital smart technologies in the management of medical services' quality continues. The central government body responsible for managing and regulating the quality of digital medical services in Australia is the Australian Digital Health Agency. This agency is funded by the government (90%) and states (10%). In 2023–2024, its budget equaled \$334.85 million (Australian Digital Health Agency, 2024). Improvement of digital support of medical services allows for reducing inequality in the provision of these services for citizens in all territories of the country.

2) Digital projects and platforms (Australian Institute of Health and Welfare, 2025):

- My Health Record – a digital platform for the digitalization of medical records of patients (used voluntarily). This platform contains traditional services: medical statements, referrals, receipts, etc. The record also contains patients' personal data, which enables medical personnel to better select the treatment method or the way of communication with the patient (Aboriginal Health and Medical Research Council of NSW, 2025). Registration on this digital platform is allowed starting at the age of 14, and information from the digital medical record is confidential for third parties and for relatives.
- Various digital apps created by private and government operators of the market. These apps are used for monitoring of medical state and medical analytics, and can include remote connection of sensors and other devices.
- Digital apps for prescribing medications.
- Telemedicine (consultation in a digital form).

3) New digital projects and platforms. Health Connect Australia is a new national digital platform for safe input, exchange, receipt, and control of medical information. This digital platform was created as a response to problems in the work of My Health Record. The new digital platform gradually integrates the existing digital platforms and projects for systemic management of medical services and simplification of access to healthcare services.

Digital transformation of Australia's healthcare system led to an increase in the population's trust, thanks to the improvement of accessibility and enhancement of infrastructure objects of medical services. Improvement of these parameters of quality influences the market of digital healthcare in Australia. The revenue of Australia's digital healthcare industry equaled \$5.4 billion in 2024, and by 2030, the revenue of \$18.4 billion is expected (Grand View Research, 2024).

Australia uses a patient-oriented digital model of quality management in healthcare. Using the national and state budgets, the government covers expenditures for modernization of the existing system of digitalization (creation of infrastructure and improvement of digital support of processes) and institutionalization in this sector (Australian Digital Health Agency, 2024).

The next analyzed country is Sweden. Like most leading countries of the world, Sweden is on the path of modernization of digital support. In the early 2000s, Sweden started using various digital apps, platforms, and digital information solutions to raise the quality and accessibility of a wide range of medical services. As of 2025, Sweden has a digital infrastructure that, through being regulated by the government, is characterized by certain fragmentation. The national digital infrastructure ensures systemic interaction between regional hospitals, municipal healthcare establishments, and other subjects of the sector. A unified system is supposed to ensure a safe exchange of patients' data. Over 2024, due to public-private partnership and comprehensive sociological research, the regulatory and legal and program basis of regulation of the standards of digital healthcare was improved (Strategy Vision for eHealth). Its norms were brought into accordance with EU requirements (Telégén, 2025). In 2025, the EU also adopted two regulatory and legal acts setting the basis for standardization in the sphere of development and implementation of digital medical technologies (this initiative requires from medical companies to comply with clear and unified

requirements and norms) and protection of patients' data: European Health Data Space (EHDS) (European Commission, 2025a) and The Regulation (EU) 2021/2282 on health technology assessment (HTAR) (European Commission, 2025b). Although the reform of Sweden and the EU's legislation in standardization of medical establishments' activities requires significant changes, it contributes to their competitiveness in the global market environment and ensures protection of the population's rights and interests.

As of 2025, Sweden's digital medical services infrastructure consists of the following components related to industrial and manufacturing engineering:

- 1) State digital system of management of patient data (electronic health records, medical statements, referrals, receipts, etc.) and procedures of appointments to doctors – digital platform 1177.se. There is no data on the precise number of registered users, but it is safe to suppose that a lot of Swedish citizens use this digital platform. An indirect proof of that is the information that approximately 99% of receipts are issued in electronic form (International Trade Administration, 2025).
- 2) Public-private digital platforms, which offer a wide range of medical services. After the 2025 reform, these platforms offer standardized medical services. These projects include digital platforms created by the government, which help in compliance with standards. There are state-funded medical establishments and private ones. One of these platforms is the regional project Alltid Oppet of the Stockholm region and other local projects (Doktor.se, Doktor 24, Min Doktor, and Kry). Such parameters of the quality of medical services as accessibility were achieved in Sweden since 2020 due to the growth of digital infrastructure providing the services of telemedicine and medical consultations. While in 2019, the number of online appointments within digital platforms equaled 1.2 million, the indicator reached 2.4 million in 2020 (International Trade Administration, 2025).

To ensure standardization of the national digital infrastructure, Sweden uses the services of leading companies with experience in the creation and implementation of electronic health records and systems of their management, as well as software development. These are mainly leading American IT companies, in particular, Amazon Web Services, Inc., IBM, Microsoft Corporation, and others.

Since 2020, each region of Sweden has been investing in the development and implementation of medical IT; the investments reached \$1.2 billion (International Trade Administration, 2025). Similar to the above provisions on reformation of legislation on standardization of

healthcare system digitalization, this shows that Sweden chose a socially-oriented digital model of quality management in the sector.

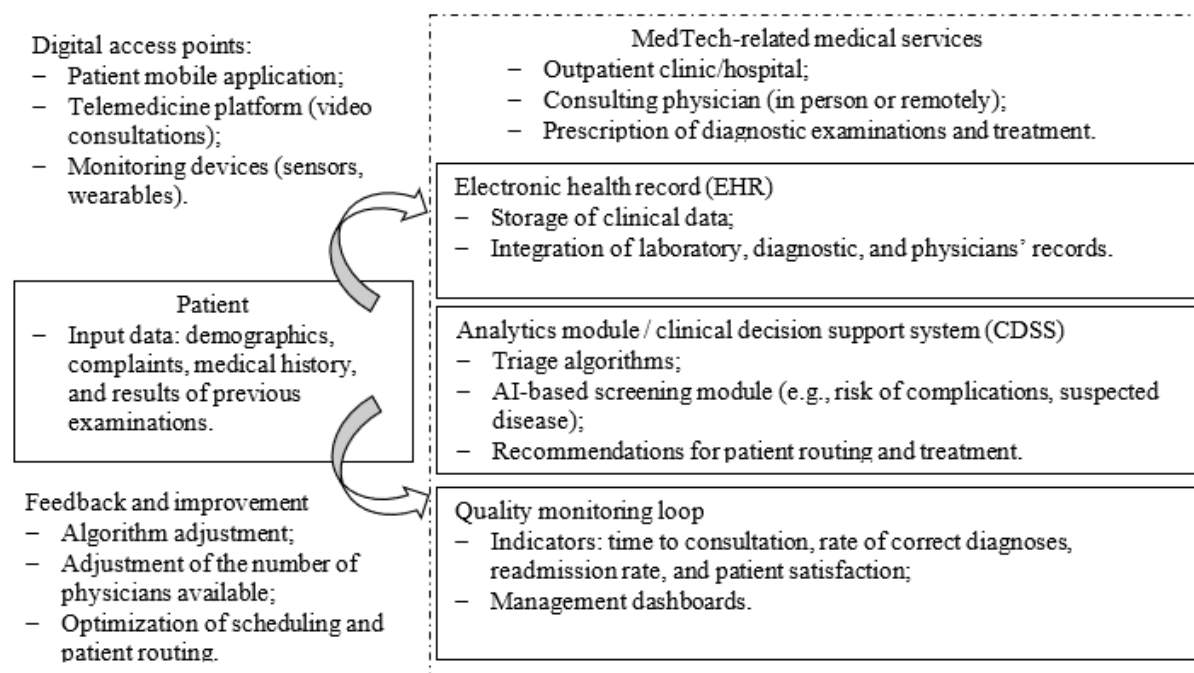
As a result of the study of the best international practices in digitalization of healthcare systems, it is possible to note common trends which include improvement of the regulatory and legal support of standards, growth of investments in new digital medical solutions, development of digital infrastructure, and the focus on population's expectations. These features of the digital transformation emerged as a reaction to possible unpredictable situations that may have a negative impact on medical services in the conditions of certain threats and challenges.

New digital medical solutions, created by IT companies and participants of the healthcare market, strive towards meeting the growing demand for high-quality medical services due to the growth of awareness of problems faced by patients, medical personnel, and other subjects of the sector. Although digital medical technologies are becoming increasingly popular among patients, the growth of their use should not be a reason for an increase in unemployment among medical personnel. In case of the replacement of medical personnel's functions with automated systems, it is necessary to retrain personnel for other positions and responsibilities.

In summarizing the empirical study of advanced international experience based on successful practices in developed countries, the benefits and essential role of industrial and manufacturing engineering for digital technologies used in healthcare should be recognized as necessary conditions for ensuring high quality in MedTech.

4.2 Digital Model of Healthcare Quality as an Engineering System

Digital healthcare, from an engineering perspective, is described as a system of interconnected subsystems, including EHRs, telemedicine, diagnostic algorithms, mobile applications, and patient routing systems. The overall quality of healthcare is linked to the technical characteristics of these subsystems, such as the latency of telemedicine services, the completeness of electronic records, the accuracy of diagnostic algorithms, and application availability. It is proposed to introduce a digital healthcare quality index, for example, combining indicators of access, accuracy, and safety, which can be calculated across countries and scenarios. The design of a digital healthcare quality system should be guided by the digital healthcare quality framework presented in Figure 1.



Source: Compiled by the authors

Figure 1. Digital healthcare quality framework.

The diagram should depict the patient, the mobile application, the telemedicine platform, the electronic health record, the diagnostic module, the clinical decision support system, the physician, and the monitoring loop for treatment outcomes. It is important to indicate that data continuously circulate among the access points, the EHR platform, and clinical decision-making processes, and are then used to assess quality, routing speed, and the safety of medical services. A separate module of the diagram may represent a dashboard of managerial KPIs for a hospital or a regional healthcare system.

A strong international example is the experience of South Korea, where the BESTCare 2.0 system and the digital hospital infrastructure ensure a high level of integration of EHRs, telemedicine, and clinical analytics. Similarly, Australia is developing My Health Record and Health Connect Australia as platforms for the secure exchange of medical information and the digital delivery of healthcare services. These cases demonstrate that the quality of healthcare is increasingly being designed as a function of the architecture of the digital system rather than solely of physicians' qualifications and the volume of funding. Accordingly, MedTech practices can be directly used as an engineering foundation for modernizing the quality of healthcare services.

5. DISCUSSION

The research results contribute to the literature by Kim et al. (2026), Qaiser et al. (2026), and Xia et al. (2026), and supplement the scientific theory of industrial and manufacturing engineering for digital technologies with a previously lacking explanation of the benefits of

industrial and manufacturing engineering of digital technologies for quality in MedTech.

In discussing the research findings, it is also important to note their contribution to the literature by Gonzalez-Gonzalez et al. (2026), Ishfaq et al. (2026), and Kingkaw et al. (2026), which lies in a more in-depth examination of engineering and technical support for quality during the technological modernization of healthcare, accompanied by its digital automation and resulting in the development of MedTech.

The new findings obtained in this research reinforce the previous literature by Khalili et al. (2026), Shafique et al. (2026), and Solaru et al. (2026) with additional empirical evidence and stronger scientific arguments, thereby confirming and demonstrating that the industrial and manufacturing engineering of MedTech creates broad opportunities and prospects for improving quality within the digital healthcare quality management model implemented in developing countries.

We identified digital models of the management of healthcare quality in the leading countries. The models have common and different features, depending on strategic approaches and achieved results. We dwelt on two similar models, one of which is oriented towards the satisfaction of the population's interests, and another – on the balance of interests of citizens and priorities of the medical services market's subjects. The second model seems to be more just, since the focus on the interests of companies and organizations in the healthcare sector allows for regulation of the labor market and support of employment. This model could be called market-

oriented, for adopting it, the government shows that it protects the rights and interests of businesses and investors. The need to stimulate investments in the digitalization of the medical sector is an important direction for managing the financial support of the quality of services in this sector. Given the importance of support for the subjects of the medical services market, it is expedient to create a system of standardization of digital services that would not allow for neglect of the issues of security of personal medical information of patients, would retain high parameters of medical services, and prevent the emergence of monopolies in certain territories. This is especially relevant for remote or rural territories, whose population does not always have the proper access to digital medical services.

Since, at the current stage, provisions of the Industry 5.0 concept are actively implemented in all sectors, it is important to stimulate the creation of digital smart solutions that would contribute to supporting the HR potential of the healthcare system in the conditions of the quick digital transformation of medical services. This could be digital solutions for quick and precise reactions to problems in diagnostics, treatment, etc. Medical establishments' personnel could also be supported using social bonds, guaranteed by the government. This measure would allow investors to be participants in such modern social trends as support of the social component of the sustainable development of regions and the country overall (Nosratabadi et al., 2023). These measures must be a part of the response to modern challenges and threats to digitalization, for sustainable social development of human resources.

4. CONCLUSION

In summary, the following overarching conclusion can be drawn: the digital healthcare quality management model used in developing countries should be supplemented with an engineering and technical component, which will ensure the model's operational stability and improve its effectiveness.

This research showed that the leading economically developed countries have a highly developed digital infrastructure of healthcare, supported by public and private investments, a regulatory and legal framework, digital readiness of citizens for the use of electronic services, and other factors. Digital models of quality

management in developed countries' healthcare systems contribute to the achievement of strategic national goals. Given the existing socio-economic and technological realities, adaptation of these models is not easy in the conditions of developing and underdeveloped countries. This is largely due to the factor of insufficient digital readiness of the population and medical personnel for digital consultations, diagnostics, and treatment; the factor of the absence of guarantees of protecting investments in the digitalization of medical services; and the factor of an insufficient level. Though the latter factor is important in the formation of digitalization in the healthcare sector, an improvement in the investment climate may provide opportunities for the creation or modernization of digital infrastructure objects.

To implement digital transformations in healthcare in developing countries, it is possible to use public-private partnerships, which would work on large-scale projects on the creation of unified national systems of medical services management. Since these projects entail risks, it is expedient to perform a complex modeling of their list and the level of threats that may influence the return on investments in the creation and implementation of comprehensive digital solutions. Management of these projects can take place on parity terms, with the milestones being the achievement of planned indicators of return on investments and the growth of the quality of medical services.

The digital healthcare quality management models systematized and described in detail in this article, which incorporate advanced international achievements in the industrial and manufacturing engineering of MedTech quality, are recommended for implementation in developing countries. The existing models used in these countries should be improved by incorporating an engineering and technical component.

Supporting the implementation and application of digital technologies with comprehensive engineering and technical assistance, in accordance with the authors' recommendations based on advanced international experience, will ensure that these technologies are adapted to the specific practices being automated and will also guarantee their proper operation without failures or technical errors. The applied solutions for industrial and manufacturing engineering proposed in this research will improve quality in MedTech.

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