International Journal of HEalth and MAnagement Sciences
(IJHEMAS)
Vol.1 No.1 (2025) pp. 29-33

Research Article

Digital Systems Management in Healthcare and Next-Generation Services

Kamran Kamal[1]

[1]Istanbul Okan University Vocational School, Istanbul Turkey
* **Corresponding Author Email:** kemran1234535@gmail.com - **ORCID:** 0009-0003-0229-513X

Received: *11September 2025* **|** ***Revised:*** *21 November 2025* **|** ***Accepted:*** *27 November 2025* **|** ***DOI:*** *10.22399/ijhemas.9*

Abstract

In a globalizing world, digital transformation has become the most dynamic driving force fundamentally altering the delivery, management, financing, and patient experience of healthcare services. This article comprehensively examines the structural components of digital systems management in healthcare, artificial intelligence (AI) typologies, the Internet of Things (IoT), clinical decision support systems, and the operational, economic, and ethical dimensions of these processes. Within the scope of this study, multi-layered transformation processes extending from data management to ethical governance are conceptualized under the light of literature through the "AKSEM Model" (AI-Powered Intelligent Healthcare Ecosystem Management Model), which has been integrated by drawing from the source text. Effective management of digital systems in healthcare institutions is of critical importance in terms of mitigating risks such as automation bias, ensuring cybersecurity, controlling costs, and generating sustainable clinical value.

Keywords: Keywords: Healthcare Management, Artificial Intelligence Typologies, Smart Healthcare Ecosystem.

1. Introduction

In the 21st century, the acceleration of technological innovations, shifting demographic structures, and global crises render traditional reactive healthcare delivery models insufficient. Reactive approaches, which traditionally intervene only after a disease manifests, are being replaced by proactive, preventive, and data-driven integrated digital systems. The increase in global aging rates and the proliferation of chronic diseases place an escalating burden on current healthcare infrastructures, making digitalization a structural necessity rather than a mere preference. Digital transformation in healthcare refers not only to the mechanical digitalization of medical devices but also to the holistic restructuring of administrative, financial, logistical, and clinical processes. "Healthcare 4.0" and "Intelligent Healthcare Ecosystems," which have emerged through the adaptation of Industry 4.0 principles to the sector, aim to establish a seamless connection between humans, machines, and data. Artificial intelligence technologies, characterized as the technological pinnacle of human history, offer meaningful contributions to life on one hand, while bringing along threat scenarios due to their rapid advancement on the other. In this context, managing digital systems with correct strategies is a fundamental prerequisite for optimizing scarce healthcare resources and sustainably increasing service quality. [1]

2. Structural Components of Digital Systems Management in Healthcare

The management of digital systems in healthcare organizations is a macro-level ecosystem architecture that goes beyond isolated software programs. Built on the foundation of information technologies, the main pillars of this

architecture consist of Hospital Information Management Systems (HIMS), Electronic Health Records (EHR), telemedicine infrastructures, and Clinical Decision Support Systems (CDSS). Managing these systems from a single center with a modular and flexible architecture is the only way to prevent the formation of data silos (disconnected data pools).

2.1. Fundamental Objectives of Managerial Strategy

- **Interoperability and Compliance:** This refers to the ability of different medical technologies and software to communicate through a common language (such as HL7 and FHIR standards). The capacity for integration not only connects systems technically but also ensures full legal, ethical, and technological compliance among various stakeholders within the healthcare services ecosystem.
- **Data Security and Privacy:** Since health data constitutes the most sensitive category of personal data, it must be protected against cyber threats within the framework of international standards and ethical principles (WHO, KVKK, GDPR). Penetration testing, end-to-end encryption, and blockchain-based data storage solutions serve as the managerial tools of this layer.
- **Process Optimization and Lean Management:** HIMS and digital integrations accelerate the flow of processes by reducing patient waiting times, supporting paperless hospital processes (HIMSS O-EMRAM), and achieving substantial savings in human resources and time. [2]

3. The Concept of Artificial Intelligence and Its Typologies in Healthcare

The European Commission on Human Rights defines artificial intelligence as an overarching, inclusive concept embodying the data, information, science, software, technique, and design necessary for machines to perform tasks and operations that require intelligence. The unique anatomical structure, neural networks, and high information-processing capacity of the human brain serve as the primary reference point in designing these systems (especially artificial neural networks). Artificial intelligence applications encountered in healthcare management are classified under three main headings in the literature based on their capabilities and scope: [3]

AI Typology	Core Function in the Healthcare Sector	Current Status / Literature Example
Narrow (Weak) AI	Algorithmic systems trained to execute a single, specific task within defined and limited domains.	Tumor detection in CT and MRI images, facial recognition systems. *(Bünyamin Akalın ve Ümit Veranyurt, 2022)*
General AI	Systems demonstrating versatile thinking, learning, and reasoning capabilities equivalent to or exceeding almost all capacities of the human brain.	Robotic surgery assistance, autonomous diagnosis based on multi-symptom analysis. *(Ben Goertzel, 2014)*
Super AI	A vision aimed at creating machines that far surpass human intelligence and cognitive capacity in every field.	Currently in a conceptual and theoretical stage; holds the potential to simulate global pandemic scenarios within seconds. *(James Pohl, 2015)*

4. Next-Generation Healthcare Services and Clinical Effectiveness

By classifying and analyzing reliable and big data generated in clinical environments, artificial intelligence-based decision support systems make information readily available for clinicians. This plays a critical role in the dissemination of evidence-based and scientific medical practices rather than relying on personal intuitions.

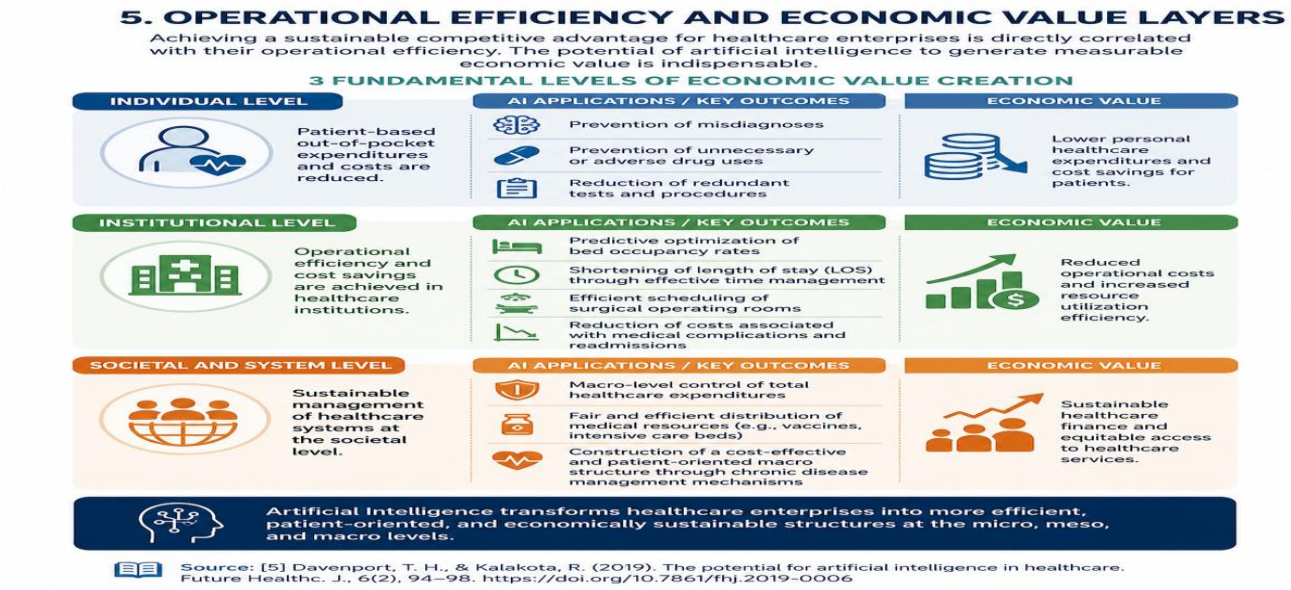
4.1. Department-Specific Next-Generation Applications

- **Radiology and Medical Imaging:** Deep learning and computer vision algorithms minimize diagnostic errors by capturing microscopic details that might elude the human eye during medical image analysis. For instance, it has been established that false positive and false negative rates in breast cancer screenings (mammography) radically decrease as training data increases.
- **Intensive Care Processes:** Machine learning models are of vital importance in intensive care units where time sensitivity is high. Thanks to these models, the mortality risk of septic patients can be predicted hours in advance, and life-saving proactive interventions can be planned through early diagnosis and cardiac arrest risk analyses.
- **Digital Pathology:** This is the process of converting traditional microscope slides into digital, high-resolution images. Aiming to increase diagnostic accuracy and speed, intelligent machines do not intend to replace pathologists but rather seek to maximize their clinical decision quality.
- **Genomic Medicine and Personalized Treatment:** Big data analytics can process an individual's genetic structure, biological variations, and lifestyle within seconds. Especially in oncology, personalized diagnosis and treatment plans are formulated through smart drug applications, thereby rendering prognosis predictions foreseeable [3,4].

5. Operational Efficiency and Economic Value Layers

Achieving a sustainable competitive advantage for healthcare enterprises is directly correlated with their operational efficiency. Rising costs in the sector, scarce resources, and complex structures render the potential of artificial intelligence to generate measurable economic value indispensable. Economic value creation occurs at three fundamental levels:

- **Individual Level:** Thanks to algorithms, patient-based out-of-pocket expenditures and costs are reduced by preventing misdiagnoses, unnecessary or adverse drug uses, and redundant tests and procedures.
- **Institutional Level:** Predictive optimization of bed occupancy rates in hospitals, shortening the length of stay (LOS) through effective time management, efficient scheduling of surgical operating rooms, and reduction of costs associated with medical complications and readmissions are achieved.
- **Societal and System Level:** Macro-level control of total healthcare expenditures and the fair and efficient distribution of medical resources (ranging from vaccines to intensive care beds) are ensured. A cost-effective and patient-oriented macro structure is constructed through chronic disease management mechanisms [5].



6.Critical Risk in Digital Health Management: Automation Bias and Ethics

One of the greatest managerial and ethical risks encountered in the integration of next-generation systems is the sense of over-reliance developed by users. This condition, conceptualized as *automation bias*, represents the tendency of clinicians to accept the reports and recommendations of artificial intelligence algorithms as unconditionally correct without subjecting them to any personal evaluation, validation test, or clinical reasoning.

This risk escalates particularly in the automated reporting of radiological images or laboratory results. Because this situation can weaken clinical reasoning and potentially make physicians' decision-making faculties "lazy," artificial intelligence must be positioned solely in a "decision support" (assistant) role, while the ultimate legal and ethical responsibility must always reside with human intelligence. Furthermore, ensuring algorithmic transparency (*Explainable AI - XAI*) is of vital importance to prevent impartiality issues (such as racial, gender, or socioeconomic biases that may occur in health algorithms) stemming from training datasets [5-6].

7. A Holistic Approach: The AKSEM Model

Developed to manage this multi-layered digital transformation process that healthcare systems have entered, the AKSEM Model (AI-Powered Intelligent Healthcare Ecosystem Management Model) places the process within a holistic framework. The model explains the dynamic structure of intelligent healthcare ecosystems that continuously learn and update themselves through data-driven feedback loops (*Intelligent System Loop*). The model comprises five core strategic layers:

- **Data and Digital Infrastructure Layer:** The fundamental layer where raw big data is seamlessly collected via EHR, imaging systems (PACS), genomic data, wearable technology, patient monitoring, IoT, and HIMS.
- **Artificial Intelligence and Analytics Layer:** The domain where machine learning, deep learning, natural language processing (NLP), and risk prediction algorithms process, interpret, and identify patterns within unstructured raw data.
- **Clinical Value Layer:** The medical output stage where diagnostic accuracy, personalized treatment protocols, early warning systems, clinical quality, and patient safety are maximized.
- **Operational and Economic Value Layer:** The layer where resource optimization, bed management, workforce (staff shift) efficiency, logistical process automation, and financial sustainability are managed.
- **Ethical and Governance Layer:** The overarching governance layer that audits the reliability of the system through mechanisms of data security, privacy, algorithmic transparency, clinical auditing, and "human-in-the-loop" control [7].

The model argues that clinical value and economic value are two complementary outputs; however, clinical quality always takes precedence over economic value. Cost-oriented reductions implemented without improving medical service quality will increase malpractice cases in the long run, leading the system to failure [7,8].

8. Conclusion and Recommendations

The future perspective should shape itself around the question of *"how humans and machines can generate higher clinical value together,"* rather than the dilemma of *"human versus machine."* The integration of AI-powered intelligent systems in healthcare is not merely a technical method or software modification, but also a deep-rooted cultural, mindset, and organizational transformation [10]..

To successfully manage this transformation, the following strategic steps must be taken:

- Continuous medical education mechanisms must be established to enhance the vision of healthcare administrators and the digital and artificial intelligence literacy levels of healthcare professionals.
- Artificial intelligence tools must be subjected to clinical audits by independent authorities, and the boundaries of "decision support" must be clearly delineated to avoid blunt clinical reasoning, thereby minimizing the risks of automation bias through both reactive and proactive measures.
- Compliance with national and international regulations, algorithmic transparency, accountability, and data privacy principles must be implemented without compromise across all developed and deployed artificial intelligence infrastructures [10].

Referance

[1] Topol, E. (2019). *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*. Basic Books
[2] Porter, M. E. (1996). What is strategy? *Harvard Business Review*, 74(6), 61–78.
[3] Goertzel, B. (2014). *Artificial General Intelligence: Concept, State of the Art, and Future Prospects*. Springer.
[4] McKinney, S. M., et al. (2020). International evaluation of an AI system for breast cancer screening. *Nature Medicine*, 26, 1098–1103.
[5] Jiang, F., et al. (2017). Artificial intelligence in healthcare: past, present and future. *npj Digital Medicine*, 1, 1–3.
[6] Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world. *Harvard Business Review*, 96(1), 108–116.
[7] Krittanawong, C., et al. (2017). Artificial intelligence in cardiology. *Journal of the American College of Cardiology*, 69(21), 2651–2660.
[8] Parasuraman, R., & Riley, V. (1997). Humans and automation: Use, misuse, disuse, abuse. *Human Factors*, 39(2), 230–253.
[9] Obermeyer, Z., et al. (2019). Dissecting racial bias in an algorithm used to manage the health of populations. *Science*, 366(6464), 447–453.
[10] World Health Organization. (2021). *Ethics and governance of artificial intelligence for health*. WHO.

.