

MINISTRY OF EDUCATION AND RESEARCH

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SUMMARY
THESIS

MODERN TECHNOLOGIES APPLICABLE FOR IMPROVING THE
MANAGEMENT OF HEALTH SERVICES

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“ One of the great challenges in health technology is that medicine is both an enormous business and a uniquely human endeavour; it requires the ruthless efficiency of the modern manufacturing plant and the gentle hand-holding of the parish priest; it is about science, but also about art; it is eminently quantifiable and yet stubbornly not. ”

Robert Wachter, *The Digital Doctor*

KEYWORDS

Digital transformation, e-health, digital technologies, digital health, health system, health information system, smart management, digital economy.

INTRODUCTION

The adoption of digital technologies within health services has become a priority in many countries, including Romania, in response to the need to improve the quality and efficiency of medical care. Digital transformation in health field involves the use of modern technologies such as telemedicine, electronic health records, artificial intelligence and mobile applications to support the diagnosis, treatment and monitoring of patients. This transition from traditional medicine, based on direct interactions and physical records, to digital medicine, focused on the use of technology to increase the accessibility and effectiveness of medical services, marks a crucial moment in the evolution of health systems worldwide.

Digital technologies used in healthcare include telemedicine, which allows patients to consult doctors remotely through online platforms, and electronic health records, which provide quick and secure access to patients' medical information. Other important technologies include mobile apps for health monitoring, wearable devices that measure vital signs, and artificial intelligence, which can analyze large amounts of medical data to provide personalized diagnoses and recommendations. These technologies not only improve access to healthcare, but also enable healthcare professionals to provide more accurate and efficient care.

However, challenges are not lacking. The implementation of digital technologies in health requires significant investment in infrastructure, training and education for medical personnel, and the development of appropriate legislative and regulatory frameworks. There are also concerns about the security and privacy of medical data, as well as resistance to change by some actors in the health system.

The adoption of digital technologies in healthcare represents an essential step for the modernization and efficiency of medical services. While the challenges are considerable, the long-term benefits for patients and health systems are clear, and digital transformation efforts must continue to ensure quality care in the digital age.

The present work, entitled "*Modern technologies applicable for improving the management of health services*", represents a theoretical and practical approach in the field of digital technologies and the management of health services, with the *aim* of carrying out an analysis of the current stage of the digitalization of the Romanian health system.

The novelty and relevance of the topic addressed

The novelty lies in exploring and evaluating recent innovations in digital health, such as artificial intelligence, blockchain, telemedicine, and electronic health records, which have not been fully integrated or studied in the specific context of health service management. *The relevance* of this theme is vital when health systems worldwide, including Romania, face major challenges related to efficiency, accessibility, and quality, and digital technologies offer promising solutions for optimizing these aspects.

Expected results

From the scientific perspective, the results will have particular relevance through the contribution made to the specialized literature by making a thorough analysis of the digital technologies applicable in the field of health, of the factors with a determining role in the implementation of the technologies, as well as of the effects of digitization on the management of health services.

1. STRUCTURE OF THE WORK

The work is structured in two parts, the first part comprising 3 chapters, and the second part 2 chapters, preceded by an introductory section. The final section includes the chapter of *Final conclusions, personal contributions and research perspectives, the Bibliography*, respectively *the Appendices* (the research tool - the questionnaire). It contains 25 tables, 41 figures, 140 very up-to-date bibliographic references, totaling 135 pages.

In the *Introduction section*, some aspects regarding the adoption of digital technologies in health services are described. The purpose and objectives of the research, the hypotheses that support the research objectives, the novelty and relevance of the topic addressed, the expected results are presented. The paper is structured as follows,

Part I – *Synthesis of specialized literature* looks at the theoretical and empirical contributions directly related to the topic studied.

Chapter 1 – *Digital technologies and equipment*

This first chapter aims to describe digital technologies, being the tools through which the digital transformation process is carried out. 17 digital technologies and specific equipment are detailed, including customized mobile applications, Big Data, blockchain, voice search, electronic health record, 3D printing, artificial intelligence, Internet of Things, video marketing, building computer modeling, nanotechnologies, virtual reality, reality augmented reality, advanced social networking, genome sequencing, wearable technology and telemedicine. The roles, working principles, benefits and risks of these technologies are described, as well as their interconnection and complementarity in implementation and operation.

Chapter 2 – *Health systems – from traditional organization to digitization*

This chapter presents the implementation framework of digital technologies, respectively health systems. Concepts and paradigm shifts such as health system, smart hospital, smart hospital management, economic efficiency, health information system and its management are clarified. The evolution of health systems from traditional organization to digitalization and the adaptation of the Romanian system in this process, after over three decades of transition, are described. The transition to a digitized healthcare system comes with significant challenges.

Chapter 3 – *Digital transformation in health*

It presents digital transformation in a holistic perspective, using data from studies and official government sources to illustrate the complexity and scope of digitization in healthcare. Digital transformation is presented as a global phenomenon that brings significant benefits in improving patient care, operational efficiency and accessibility. Major challenges are highlighted, such as high costs, cybersecurity risks and regulatory complexities, which require strategic investment and collaboration to ensure fair access and data security. Also, the current implications and the steps taken by the Romanian health system in the process are described.

Part II – *Empirical research*

Chapter 4 – *Research on the current situation of the digitalization of the Romanian health system*

It focuses on empirical research, analyzing and interpreting data collected from 135 health professionals. It provides valuable perspectives on the current state of digitization of the health system in Romania, presenting a conceptual research model that facilitates the understanding of the relationships between goals, objectives, hypotheses, questionnaire items and conclusions. Next comes the sub-chapter presenting the research framework with the description of the socio-demographic characteristics of the sample. The sub-chapter on the research methodology describes the software used, the research instrument, the reliability testing of the variables. The analytical and graphical results, respectively the quantitative and descriptive statistical results are processed,

analyzed and interpreted in the following two sub-chapters. Next comes the hypothesis testing and validation subchapter .

Chapter 5 – Research on the factors that facilitate the acceleration of the digital transformation process in the field of health

It examines a conceptual model that integrates four essential factors for accelerating digital transformation in health: relevant institutions (ministries involved in digitization), up-to-date legislation, infrastructure and digital literacy; providing examples of good practice for each of these. These models come from health systems in: Estonia, Denmark, Singapore, Great Britain, United States of America, Australia and Canada.

The paper concludes with Chapter 6 – *Final Conclusions, Personal Contributions and Research Perspectives* , where the main conclusions are presented, includes relevant personal contributions corresponding to each chapter, theoretical and empirical, as well as research perspectives.

2. PERSONAL CONTRIBUTIONS AND RESEARCH PERSPECTIVES

In this section, some essential aspects that we have analyzed and developed in this paper will be analyzed, contributing to a better knowledge of the process of digital transformation in the field of health. The adoption of digital technologies within health services is a global process, with particularities specific to each health system.

First, the contribution made from the conceptual perspective is particularly important. Valuable, very up-to-date scientific works, based on studies carried out by researchers at the global level, published in prestigious journals, were analyzed and selected. In addition, web sources were consulted, providing up-to-date information on the listed technologies and the digitization process in health.

The contribution made through Chapter 1 is that digital technologies are understood much more easily, namely the way in which they bring benefits to the health system and the population, as well as how they support health professionals in the performance of the medical and administrative act.

The conceptual clarifications and the description of the evolution of the health systems, especially the European ones, as well as the analysis of the current situation of the Romanian health system, supported by up-to-date data, represent the contribution made through Chapter 2.

The contribution made through Chapter 3, especially regarding the Romanian health system, consists in the presentation of the concrete steps taken regarding the adoption of digital

technologies, legislative regulations, as well as the integration of factors that can influence the construction of an IT system of successful health, through an integrated approach to the process.

Contribution of Chapter 4 consists of the results obtained and interpreted, based on data obtained from active professionals, processed through specific statistical methods, which show the current state of digitization of health services, from multiple perspectives of the process.

The contribution of Chapter 5 consists in the reasoned identification and interconnection of factors that can facilitate the implementation of digital technologies at a rapid pace in the Romanian health system, based on good practice models at the global level.

Limits of research

- The research method and tool (indirect survey, respectively the online/self-administered questionnaire) present risks described in the specialized literature; with the obligation to complete all items, with an average completion time of over 24 minutes, determined a high degree of abandonment and, implicitly, the reduction of the sample volume.
- Approaching a field of activity with a particular specificity, that of health, without being part of a specific organization or in connection with an authority, created a declared reticence, the email being considered/reported as "spam".
- Lack of an up-to-date, valid email database that provides the personal email addresses of managers and not those of institutions;
- The impossibility of measuring the impact of the adoption of digital technologies on managerial performance, both due to the lack of standardized items in the research instrument, but also the low level of technology implementation.

Research ethics

- The content of the thesis complied with the requirements imposed in the Guide for preparing and writing the doctoral thesis within the University of Petroșani.
- The research tool was generated with the help of Microsoft 365 with a license, of the University of Petroșani, and the statistical processing with the help of SPSS 26, with a free license.
- Potential problems regarding data confidentiality were avoided, as no personal data was collected (only e-mail addresses were collected, with the aim of providing feedback, their transmission being optional).
- I respected the principle of objectivity throughout the research.

The research perspectives are given by the still unexplored research directions of the digital transformation in the field of health, a very dynamic process that represents an immeasurable source for scientific research. Technological advances in the field of Artificial Intelligence and Machine Learning provide opportunities for future research should explore the potential of these technologies in predicting health trends, personalizing treatment plans and improving diagnostic accuracy. These technologies have the potential to revolutionize healthcare delivery. Blockchain technology is also one of the research directions, offering promising solutions for improving the security and privacy of health data. Research in this area can address data breach concerns and build trust in digital health systems.

The cross-sectional study that was the basis of the empirical research in this paper can have as research perspectives more complex studies such as longitudinal and comparative ones. Future research should focus on longitudinal studies to assess the long-term impact of digital technologies on health outcomes. Such studies would provide deeper insights into the sustainability and scalability of digital health initiatives, and comparative ones between different regions or localities can highlight best practices and innovative solutions that can be adapted to local contexts. Thus, it can lead to a better understanding of the global context of digital transformation in health.

Research perspectives on the development and implementation of robust regulatory frameworks is crucial. Updated legislation should ensure data security, patient privacy and the ethical use of digital health technologies.

Future research should focus on developing effective programs to train healthcare professionals to improve their digital literacy. This is critical to the successful adoption and use of digital health tools.

The following research questions can be starting points for numerous studies:

How does the adoption of digital health technologies affect patient outcomes in terms of morbidity, mortality and quality of life?

What are the most effective strategies to ensure data security and patient privacy in digital health systems?

How is digital transformation affecting the roles, skills and job satisfaction of healthcare professionals?

What are the barriers and facilitators to the adoption of telemedicine and how does it affect access to care, particularly in rural or underserved areas?

How can artificial intelligence and machine learning be harnessed to improve diagnostic accuracy and personalize treatment?

How do digital health tools affect patient engagement and empowerment in managing their own health?

What are the economic implications of digital healthcare transformation for hospitals, insurance companies and patients?

What are the best practices for achieving interoperability between different digital health systems and what are the associated challenges?

How does digital transformation affect health disparities between different populations?

What are the regulatory and ethical challenges associated with digital health technologies and how can they be addressed?

How can digital health technologies improve the management of chronic diseases such as diabetes, hypertension and chronic obstructive pulmonary disease?

What are the impacts of advanced health information systems on hospital efficiency, patient care and administrative processes?

By pursuing these insights, researchers can contribute to a comprehensive understanding of digital transformation in healthcare, highlighting both the benefits and challenges associated with this change.

The digital transformation of health services is a multifaceted process that requires concerted efforts from all stakeholders. This thesis provided a comprehensive analysis of the current state and future potential of digital health in Romania.