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THE MANAGEMENT PARADIGM TRANSFORMATION IN PHARMACY: FROM TRADITIONAL MODELS TO THE USE OF DIGITAL TECHNOLOGIES

The relevance of the study is due to the impact of digitalization and crisis factors on the pharmaceutical sector, which determines the need for a theoretical rethinking of the modern management paradigm in pharmacy.

Aim. To theoretically substantiate the evolution of the management paradigm in pharmacy, identify the main stages of its transformation, and systematize the characteristics of the contemporary digital management model of pharmaceutical organizations.

Materials and methods. The information base for this study was compiled from regulatory and strategic documents (WHO, Ministry of Health of Ukraine) and scientific publications for 2015–2026, retrieved from Scopus, Web of Science, PubMed, and Google Scholar using keywords related to digitalization and management in pharmacy. The study used systemic, structural and functional, comparative, and historical-logical methods, as well as generalization and scientific abstraction.

Results and discussion. Six stages in the evolution of the management paradigm in pharmacy, such as administrative-functional, economic-market, strategic, process-oriented, patient-centered, and digital stage, have been systematized. It has been substantiated that each subsequent paradigm does not eliminate the previous one, but transforms and integrates its managerial tools in accordance with changing conditions in the pharmaceutical sector. The transition from managing resources, functions, and operations to managing end-to-end processes, relationships, data, digital platforms, as well as ecosystems, has been identified. The transformation of managerial functions from periodic planning, control, and experience-based decision-making towards dynamic forecasting, real-time monitoring, predictive analytics, automation, and data-driven decision-making has been demonstrated. The social-pharmaceutical dimension of the digital paradigm has been substantiated, within which the digital transformation contributes to improving the accessibility and quality of pharmaceutical care, strengthening patient-centredness, and increasing the social efficiency of pharmaceutical organizations. The need to combine technological efficiency with risk management, cybersecurity, human capital development, and digital resilience has been determined.

Conclusions. Digitalization is defined as a systemic transformation of the management paradigm that provides the transition from a predominantly hierarchical and reactive model to an adaptive, process-oriented, network-based, platform, and data-driven management model. Further research should focus on developing methodological approaches to assessing the digital maturity and digital resilience of pharmaceutical organizations, identifying appropriate KPIs, and studying their relationship with the quality of pharmaceutical care and social effectiveness.

Keywords: management; pharmaceutical organization; management paradigm; pharmaceutical management; digitalization; digital transformation; digital economy; data-driven management; patient-centredness; pharmaceutical care; social effectiveness; digital resilience.

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ТРАНСФОРМАЦІЯ ПАРАДИГМИ УПРАВЛІННЯ У ФАРМАЦІЇ: ВІД ТРАДИЦІЙНИХ МОДЕЛЕЙ ДО ВИКОРИСТАННЯ ЦИФРОВИХ ТЕХНОЛОГІЙ

Актуальність дослідження зумовлена впливом цифровізації та кризових чинників на фармацевтичний сектор, що зумовлює потребу в теоретичному переосмисленні сучасної управлінської парадигми у фармації.

Мета – теоретичне обґрунтування еволюції парадигми управління у фармації, визначення основних етапів її трансформації та систематизація характеристик сучасної цифрової моделі управління фармацевтичними організаціями.

Матеріали та методи. Інформаційну базу сформовано на основі нормативно-стратегічних актів (ВООЗ, МОЗ України) та наукових публікацій за 2015–2026 рр., відібраних у базах Scopus, Web of Science, PubMed і Google Scholar за ключовими запитами щодо цифровізації та менеджменту у фармації. У роботі застосовано системний, структурно-функціональний, порівняльний та історико-логічний методи, а також узагальнення і наукової абстракції.

Результати та їхнє обговорення. Систематизовано шість етапів еволюції управлінської парадигми у фармації: адміністративно-функціональний, економіко-ринковий, стратегічний, процесно орієнтований, пацієнтоцентричний та цифровий. Обґрунтовано, що кожна наступна парадигма не скасовує попередньої, а трансформує та інтегрує її інструментарій відповідно до нових умов функціонування фармацевтичних організацій. Визначено перехід від управління ресурсами, функціями та операціями до управління наскрізними процесами, відносинами, даними, цифровими платформами та екосистемами. Показано трансформацію управлінських функцій від періодичного планування, контролю та ухвалення рішень на основі досвіду до динамічного прогнозування, моніторингу в режимі реального часу, предиктивної аналітики, автоматизації та ухвалення рішень на основі даних. Обґрунтовано соціально-фармацевтичний вимір цифрової парадигми, у межах якого цифрова трансформація сприяє підвищенню доступності та якості фармацевтичної допомоги, посиленню пацієнтоорієнтованості та соціальної ефективності фармацевтичної організації. Визначено необхідність поєднання технологічної ефективності з управлінням ризиками, кібербезпекою, розвитком людського капіталу та забезпеченням digital resilience.

Висновки. Цифровізацію визначено як системну зміну управлінської парадигми, що забезпечує перехід від переважно ієрархічної та реактивної моделі до адаптивної, процесної, мережевої, платформної та data-driven моделі управління. Перспективи подальших досліджень пов'язані з розробленням методичних підходів до оцінювання цифрової зрілості та цифрової стійкості фармацевтичних організацій, визначенням відповідних КРІ та дослідженням їхнього взаємозв'язку з якістю фармацевтичної допомоги й соціальною ефективністю.

Ключові слова: управління; фармацевтична організація; парадигма управління; менеджмент; цифровізація; цифрова трансформація; цифрова економіка; управління на основі даних; пацієнтоорієнтованість; фармацевтична допомога; соціальна ефективність; цифрова стійкість.

Introduction. The pharmaceutical sector is a complex socio-economic system; its functioning is simultaneously associated with providing the population with medicines, materializing the economic interests of market entities, complying with regulatory requirements, and ensuring the quality of pharmaceutical care.

During the classical stage of the management development (20th century), the management of pharmaceutical organizations was based mainly on the principles of the administrative hierarchy, functional division of powers, standardization of operations, control of resources and fulfillment of established standards. This model functioned in conditions of the low level of dynamism of the environment, in which management decisions were made on the basis of the accumulated experience, planned indicators and retrospective analysis.

However, the development of market relations has significantly changed the nature of management activities in pharmacy. Increased competition, the formation of pharmacy chains, the development of marketing technologies, changes in consumer behavior and the need to optimize costs have led to the transition to economic and strategic management models. Important management objects have become not only resources, but also, in particular, customer relations, brand, competitive advantages, personnel, logistics processes and quality of service.

In the study, the following terms are used: “management evolution” – to denote a consistent qualitative change in the dominant principles and mechanisms of the management activity; “management paradigm” – as a set of basic ideas about the object, goals, principles and logic of

management; “management model” – as a specific representation of the organization of management processes, functions and tools within the framework of the corresponding paradigm; “stage” – as an analytically isolated state of development of the management paradigm; “approach” – as a way of organizing the management activity, which determines the priority principles and methods of its implementation.

The current stage of development is characterized by the transition to the implementation of digital technologies, which are increasingly integrated into all functional areas of pharmaceutical management – from procurement and logistics to marketing, human resources management, finance and interaction with patients.

The World Health Organization considers digital health as an important tool for improving the efficiency, sustainability and accessibility of health systems, emphasizing the need for interoperability, data security, human-centeredness and evidence-based digital solutions. At the same time, digitalization should not be seen only as the automation of individual operations. Its essence lies in changing the way information is created and used, organizing the interaction between pharmaceutical market participants, making management decisions and creating value for the patient. It is necessary not only to define digital tools, but also to scientifically substantiate how the management paradigm itself is changing.

The issues of the digital transformation of pharmacy include the development of digital technologies in pharmaceutical care [1, 2], online platforms and telepharmaceutical services [3–6], digital therapeutics [7], the use of artificial intelligence [8, 9], digitalization of supply chains [10, 11], digital risk management [12] and overcoming digital inequality [13, 14]. Strategic guidelines for the digitalization of healthcare have been defined by the WHO [15]. Along with this, the architecture of digital technologies [16], the principles of procurement and supply management design [17], research on the stress resistance of human resources [18, 19] and modeling of investment and strategic development [20] are also important. At the same time, the complex transition of pharmaceutical organizations from traditional management models to the digital paradigm remains insufficiently covered, and necessitates its theoretical substantiation.

The aim of the study was to theoretically substantiate the evolution of the management paradigm in pharmacy, identify the main stages of its transformation, and systematize the characteristics

of the modern digital model of management of pharmaceutical organizations.

Materials and methods. The information base of the work was formed by analyzing scientific publications and regulatory and strategic acts for 2015–2026 (“WHO Global Strategy on Digital Health for 2020–2025” and draft and current regulatory and strategic guidelines of the Ministry of Health of Ukraine for the development of the healthcare system until 2030). A systematic search for relevant sources was carried out in the Scopus, Web of Science, PubMed and Google Scholar databases using such descriptors as “pharmaceutical management”, “digital transformation in pharmacy”, “telepharmacy”, “data-driven pharmacy”. The inclusion criteria were the peer-reviewed review and original articles on the managerial, economic and social aspects of the digitalization of pharmacy, as well as the specified strategic acts of the WHO and the Ministry of Health of Ukraine. The exclusion criteria included publications devoted exclusively to the chemico-pharmaceutical synthesis, development, or clinical trials without a managerial-economic context.

The methodological basis was the systemic and historical-logical approaches, which made it possible to consider the evolution of management as a consistent transformation of interrelated principles, functions and management tools. To compare traditional and digital management models, the structural-functional and comparative methods, methods of generalization and scientific abstraction were used.

The scientific novelty of the study was in the systematization and conceptualization of the stages of evolution of the management paradigm in pharmacy – from administrative-functional to digital – with the definition of the transformation of management objects, management tools, the nature of decision-making, and efficiency criteria.

Results and discussion. The evolution of the pharmaceutical organization management should be considered as a consistent transition from the resource and operations management to process, relationship, data, and digital ecosystem management. Based on the generalization of theoretical approaches, we propose to identify six main stages of the management paradigm transformation.

The first stage of the evolution of the pharmaceutical management (1990–2000s) was characterized by the dominance of the administrative-functional management model, which was based on strict regulations and compliance with regulatory requirements. The pharmaceutical

organization was considered as a structured system with clearly defined functions, powers and responsibilities of each employee. The main management functions were planning, organization, motivation and control, with a significant part of decisions being made centrally, and information flows moving through vertical channels. For a pharmacy, such a model provided for the control of inventory, compliance with regulatory requirements, organization of the personnel work, ensuring proper storage conditions, control of financial and commodity discipline and the implementation of planned indicators.

Subsequently, the formation of a competitive pharmaceutical market led to a transition to an economic-market model where the focus was not only on the processes of providing medicines, but also on the economic results of activities along the chain of income – expenses – profit – profitability – market share. During this period, marketing, assortment management, pricing, category management, sales promotion and competitive analysis gained active development, and the pharmaceutical organization began to be perceived as a market entity capable of ensuring its own economic sustainability.

However, a purely economic orientation proved insufficient due to the direct impact of pharmaceutical activities on public health, which led to the development of the strategic and patient-centered management [20]. The strategic approach-oriented management is aimed at forming long-term competitive advantages, taking into account

market, regulatory, technological, human resources and financial factors.

The further evolution of management was logically connected with the transition from the management of individual functions to the management of end-to-end business processes and a customer-centric paradigm [17]. The process of providing a patient with a medicine includes demand forecasting, purchasing, logistics, receiving, storage, display, drug search, consulting, dispensing and after-sales interaction. The effectiveness of these stages is assessed not only by sales volume, but also by the speed of service, the availability of the necessary drug, price, the quality of the consultation, the patient satisfaction and continuity of pharmacotherapy.

Unlike previous stages, the modern digital paradigm is significantly different in the change in the nature of the management information. Information from a tool for controlling past events is transformed into a means of monitoring, forecasting, modeling, automation, personalization and decision-making, making management proactive and predictive. If in the traditional model the logic was based on the chain of “resources – operations – control – result”, then the digital model forms a closed cyclical process of “data – analytics – forecast – decision – automated action – result – new data”, which is a key characteristic of the data-driven management. Digitalization changes not only the technical support of a pharmaceutical organization, but also the content of the main management functions (Table).

Table

TRANSFORMATION OF MANAGERIAL FUNCTIONS AND FUNCTIONAL AREAS OF MANAGEMENT IN THE CONTEXT OF DIGITALIZATION

Category	Traditional approach	Digital approach (Data-driven)
I. General management functions		
Planning	Periodic (annual/quarterly) plans based on retrospective data	Dynamic predictive forecasting in real time
Organization	Rigid hierarchical structure, functional division	Flexible networked and cross-functional digital processes
Motivation	Standard financial KPIs, fixed salaries	Personalized flexible KPIs, engagement and performance analytics
Control	Periodic inspections, retrospective analysis of deviations	Continuous real-time monitoring (dashboards)
Decision making	Intuitive and experiential approach, manager's decision	Data-driven decision making
II. Functional areas (Areas of activity)		
Inventory management and logistics	Fixed order points, minimum/maximum balances	AI demand forecasting, ubiquitous digital route optimization
Marketing and patient engagement	Mass advertising campaigns, focusing on one-time sales	Personalized marketing, CRM management and Omnichannel experience
Human Resources Management (HR)	Administrative and personnel accounting, paper document management	People analytics, digital educational platforms

Thanks to the introduction of modern technologies, digital systems integrate data on sales, inventory and consumer behavior to forecast demand, support the formation of logistics orders, optimize inventory and plan marketing activities. An important tool of the digital management paradigm is artificial intelligence, which expands the possibilities of forecasting, analytics and support for management decisions [10, 11, 21].

As a result, the role of the pharmaceutical manager is qualitatively transformed: if the manager in the traditional management model focuses mainly on manual information collection, its linear analysis and making intuitive and experienced decisions, then the modern digital leader determines the architectural parameters of the system, controls the validity and quality of input data, interprets algorithmic recommendations and forms final strategic decisions. At the same time, comprehensive automation does not involve the exclusion of the human factor from the management circuit, but on the contrary, actualizes such key competencies as critical thinking, deep interpretation of analytics, organizational change management, cross-functional communications and adherence to ethical standards of high technology use [18, 19, 22]. If in the previous stages of the basic asset management, material and technical resources, financial capital, staff and physical inventories were used, then in the digital system data becomes a strategic resource [16].

The integration of these arrays forms a single information management environment that is fully consistent with the global concepts of digital health, focused on ensuring high interoperability, secure data exchange and making informed decisions. Accordingly, the competitiveness of a pharmaceutical organization in the digital economy is determined not simply by the volume of accumulated information, but by the organization's ability to consistently go through all stages of its life cycle: acquisition, integration, deep analysis, correct interpretation and practical use [23]. This necessitates the need for digital literacy, analytical thinking, competencies in the field of AI, change management, cybersecurity and digital ethics.

It is worth emphasizing that the digital transformation of management in pharmaceutical organizations has not only a technological and economic, but also a pronounced socio-pharmaceutical dimension. Its effectiveness should be assessed not only by indicators of the operational efficiency, speed of management decision-making or cost

optimization, but also by the ability to ensure accessibility, proper quality and continuity of pharmaceutical care [24, 25]. In this context, the digital paradigm changes the logic of management: information systems, digital platforms, CRM, ERP, analytical tools, electronic document management and artificial intelligence technologies become means not only of optimizing internal processes, but also of increasing the social value of the activities of a pharmaceutical organization.

One of the key social effects of digitalization is the increase in the availability of pharmaceutical care. The use of digital communication channels, electronic services, online ordering and reservation of medicines, digital inventory management systems and integrated information platforms helps to reduce time and organizational barriers to obtaining pharmaceutical services [3–6]. At the same time, the social effectiveness of digitalization depends on the extent to which these tools actually expand the possibilities of obtaining pharmaceutical care for different groups of the population. Therefore, along with digitalization, it is necessary to take into account the risks of digital inequality associated with differences in access to the Internet, digital devices, digital skills and the ability to use online services [13, 14].

Increasing accessibility creates the prerequisites for improving the quality of pharmaceutical services and moving to a more pronounced patient-centered management model. At the same time, patient-centeredness should not be identified exclusively with the customer service or marketing personalization. In the socio-pharmaceutical context, it involves focusing management decisions on human needs, the safety and proper quality of pharmaceutical care, the availability of necessary medicines, informing and supporting

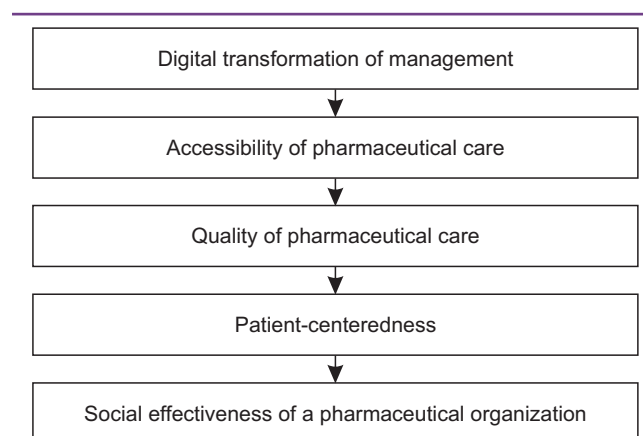


Fig. 1. The socio-pharmaceutical model of the impact of the digital management transformation on the social effectiveness of a pharmaceutical organization

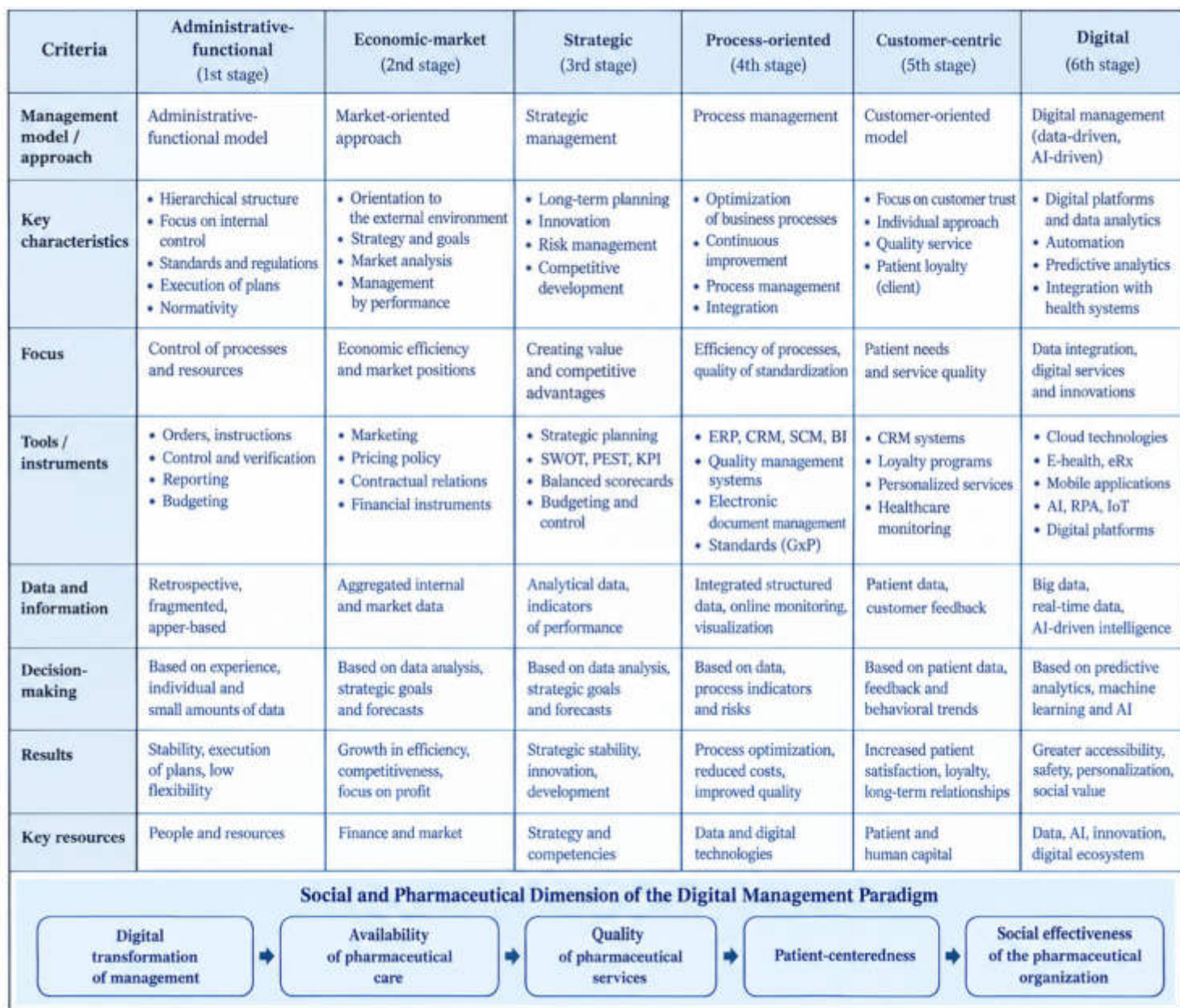


Fig. 2. The author's conceptual model of the evolution of the management paradigm in pharmacy taking into account the social and pharmaceutical dimension

the rational use of medicines [1, 2]. Therefore, digital technologies acquire social value only if they are aimed at improving the real experience and results of the recipient of pharmaceutical care.

In the digital paradigm, it is advisable to include not only financial and operational indicators, but also the accessibility of pharmaceutical care, patient satisfaction, quality of service, timeliness of provision of medicines and the effectiveness of digital channels of interaction in the performance criteria. The socio-pharmaceutical dimension of the digital paradigm can be represented as an interconnected chain shown in Fig. 1.

In parallel with the development of services, the digital transformation requires proper risk management, data protection and consideration of digital inequality [12, 13]. The digital management model acquires particular importance in crisis conditions, which is extremely relevant for the pharmaceutical sector of Ukraine. Digital tools increase the adaptability of organizations through operational monitoring of stocks, demand forecasting, logistics optimization and remote interaction with patients. At the same time, cyber risks, threats of data leakage, dependence on the digital infrastructure and risks of digital inequality arise.

The conceptual model of the evolution of the management paradigm in pharmacy, taking into account the socio-pharmaceutical dimension, is presented in Fig. 2.

The identification of six stages of the evolution of the management paradigm (administrative-functional, economic-market, strategic, process-oriented, patient-centric and digital) is based on the chronological and content analysis of fundamental works on management and social pharmacy. The main criteria for distinguishing the stages were selected: the key object of management (from resources to data); the nature of decision-making (from empirical/reactive to predictive/data-driven); the leading criterion of effectiveness (from compliance with standards to socio-economic sustainability).

The theoretical basis for the formation of the first three stages was the classical concepts of management and pharmaceutical marketing [20]; the process-oriented and patient-centric stages – research on social pharmacy and pharmaceutical care [1, 2, 17]; the digital stage – modern works in the field of the digital transformation, artificial intelligence and telepharmacy [3–12, 16, 21–25].

At the sixth, digital stage, value is created through the integration of data, digital platforms, AI, automation and adaptive management, which combines economic, operational and social efficiency. The conceptual model proposed demonstrates

that the digital paradigm combines external influencing factors – economic, social, technological, regulatory and crisis – into a single loop through the functioning of an integrated digital management system. It processes data using analytical tools and AI, transforming them into management decisions, automated business processes, KPI monitoring and constant adjustment of the strategy. A comparative analysis of the stages of the management evolution proves the systemic nature of these changes: from ensuring basic manageability at the initial stage and economic efficiency at the second one, to the formation of long-term competitive advantages at the third stage, process optimization at the fourth one and creating a unique value proposition for the patient at the fifth stage.

Conclusions and prospects for further research

1. The theoretical study has made it possible to systematize the evolution of the management paradigm in pharmacy and identify six interrelated stages of its development; they are administrative-functional, economic-market, strategic, process-oriented, patient-centric and digital stages. It has been found that the modern digital paradigm does not replace previous models, but integrates their tools based on data, digital technologies, end-to-end processes and adaptive management.

2. It has been shown that digitalization changes the nature of management decisions, ensuring a transition from predominantly reactive management to forecasting, data-based decision-making, automation and continuous monitoring. At the same time, it is advisable to evaluate the digital transformation effectiveness not only by economic and operational indicators, but also by the availability and quality of pharmaceutical care, patient-centeredness and social efficiency.

3. The scientific value is the systematization proposed for transformations of the management paradigm and the substantiation of its socio-pharmaceutical dimension, which is represented by the relationship between the digital transformation of management, the availability of pharmaceutical care, the quality of service, patient-centeredness, and social efficiency of a pharmaceutical organization.

Further research should be directed towards developing methodological approaches to assessing the digital maturity and digital resilience of pharmaceutical organizations, identifying appropriate KPIs, and studying their relationship with the quality of pharmaceutical care and social effectiveness.

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O. Yu. Rogulya: research methodology.

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