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Strengthening the Competitiveness and Adaptability of Serbian Pharmacies in the Digital Era

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Abstract
Pharmaceutical Humanities along with Narrative Pharmacy establish an expanding interdisciplinary method that brings humanistic approaches and ethical and narrative practices to pharmaceutical practice. The focus of this concept underscores the importance of patient stories together with empathy along with cultural awareness in medication therapy management to improve patient-centered care. Through its interdisciplinary approach Narrative Pharmacy creates stronger relationships with patients and enhances healthcare communication and makes healthcare decisions more ethical for pharmaceutical care delivery. The developing field demonstrates why storytelling techniques together with ethical considerations and social science methods need to form the basis of complete pharmaceutical educational approaches and clinical practice methods.

Keywords: ***Digital economy, business resilience, competitiveness, Serbian pharmacies, digital transformation, e-commerce, supply chain management, customer engagement, automation, regulatory challenges, cybersecurity, workforce upskilling, digital adaptation, pharmaceutical sector, business sustainability.***

1. Introduction

The evolution of electronic systems in economic operations and health sector transformations requires detailed investigation.The digital economy exists when businesses integrate information technology into their economic operations to promote market innovation through digital systems while making decisions based on data. The concept became an essential economic force after it gained popularity in the late twentieth century. The pharmaceutical and healthcare businesses as well as other sectors have undergone transformative changes from the growth of digital tools alongside cloud computing and automation and artificial intelligence (AI). Contactless services alongside electronic health records (EHRs) and online healthcare consultations became vital due to the COVID-19 pandemic as it pushed forward digital transformation even faster. The pharmaceutical industry has undergone significant changes through digitalization because it makes medication management and prescription handling and patient counseling services more efficient. Business sustainability and compliance with regulations together with competition stand as critical reasons for the 4000 pharmacies in Serbia to implement digital solutions. Prescription automation combined with AI patient management programs and digital communication tools together with telepharmacy functions constitutes the scope of pharmacy operational digitization(1). The adoption of digital tools improves operational efficiency at the same time it makes pharmacies compatible with future healthcare requirements from both global organizations and regulatory bodies.

Challenges and Opportunities in the Digital Healthcare Sector

The digital healthcare transformation brings numerous benefits but healthcare organizations must resolve its identified obstacles to reach maximum potential. Digital tool integration poses a critical issue because physicians must maintain essential services during implementation. Healthcare professionals together with pharmacists need to master new technologies through permanent education programs and digital skills development platforms to adapt successfully. Healthcare entities must implement proper management practices to address both cybersecurity vulnerabilities and data privacy requirements and healthcare regulations as part of ensuring patient information security and preventing breaches. Several pharmacies use automated inventory management with online consultation services together with digital marketing tactics yet other facilities face challenges from poor infrastructure and staff reluctance to change and budget limitations. Concurrently with the increased importance of digital-first pharmacies emerge numerous new business benefits(2). Through e-commerce in pharmaceuticals patients now have access to online medicine purchases together with teleconsulting services alongside home delivery which enhances convenience while ensuring easier accessibility. Pharmacists leverage AI-based analysis to customize treatments while accurately forecasting medicine needs and manage stock better which results in better service quality and satisfied clients.

Role of Pharmacies in the Digital Healthcare Ecosystem

The healthcare infrastructure depends on pharmacies to assist patients through drug prescriptions and OTC products as well as professional disease management and drug counseling services. Digital health platforms with e-prescriptions transformed pharmacies into centers that go beyond medication delivery to provide patient remote monitoring and manage chronic diseases and run preventive healthcare programs. Digital health records together with AI-based prescription validation systems operate as operational efficiencies which minimize prescription and drug interaction errors. Digital platforms enable uninterrupted communication between medical staff and pharmacists and patients thus creating effective prescription processing systems. Pharmacies in Serbia need to support national e-health initiatives through the integration of cloud-based medical data management in addition to automated billing platforms and AI-based pharmaceutical assistance(3).

The Need for Digital Competitiveness and Business Resilience

Digital economy success for pharmacies depends on strategic development of their competitive strength combined with business operational resilience. The pharmaceutical industry determines its competitive position through combined factors which include service quality and pricing models and technological development and patient interactions. When pharmacies implement digital solutions they gain the advantage to fulfill consumer needs as people choose digital health features including online consultations and mobile prescription refills along with tracking tools. Business resilience proves essential for pharmacies to survive through economic shifts and regulator changes as well as technological disturbances(4). Business resilience strategies require organizations to commit resources to digital systems as well as educate personnel in new technologies and develop flexible business frameworks that support fast-moving industry trends. Pharmacy operation efficiency grows with AI-driven decisions and analytics and cloud-based systems to increase sustainable long-term relationships with customers.

Research Scope and Objectives

The research studies the effects of digital transformation on pharmaceutical business performance along with focus placed on analyzing Serbia's pharmacy chain. This longitudinal research investigates pharmacist and technical staff experiences with digital adoption along with their professional development on digital learning platforms and e-prescription system effectiveness through repeated data collection at different times. The research delves into the benefits provided by digital tools to improve pharmacy management processes as well as employee performance and customer satisfaction numbers. The analysis of these elements will deliver important knowledge about how small and mid-sized pharmacies should implement digital technology to survive in a progressively digital healthcare sector(5).

2.Materials and Methods

Research Design and Theoretical Framework

The research mixes quantitative survey methodology with qualitative assessment methods to determine digital transformation effects on pharmacies regarding operational management and business adaptability and practitioner enhancement. The research used a longitudinal approach which allowed tracking digital adoption along with its evolving effects across different measurement points. This study relies on the Technology Acceptance Model (TAM) together with Diffusion of Innovation Theory (DOI) as its theoretical foundation to explain technology adoption processes between individuals and organizations. Implementation of technology depends on perceived usefulness and ease of use according to TAM but DOI dictates how innovations spread throughout industries through relative advantage and compatibility measurements and complexity assessment and observability evaluation(6). Recognizing these important factors becomes essential since digitalization continues to shape pharmaceutical operations at the employee engagement and organizational transformation readiness levels as well as operational efficiency levels.

Study Population and Sample Selection

The study used the five pharmacies of Hygia Pharmacy located in Arandjelovac Serbia as its research setting. Twenty-three employees consisting of pharmacists and pharmacy technicians working with digital tools were studied as part of the research population. The study selected participants based on their practical involvement with digital pharmacy operations through e-prescriptions and digital sales systems and online consultations and automated inventory systems. The research participants came from different backgrounds including their age range and experience duration alongside their digital literacy abilities which allowed diverse viewpoints about digital

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transformation to be studied. Through this research method the researchers obtained a fair representation of how various employee populations affect their perspectives toward digital adoption alongside their developmental needs and business resilience measures(7).

Data Collection Methods and Instruments

The research relied on an internet-based questionnaire which was provided at three point intervals during the first period and following three months and six months. The research instrument contained questions that aimed to evaluate workers' views about digital implementation and office performance and staff development possibilities. The questionnaire included multiple-choice questions together with closed-ended questions and Likert scale measures which examined diverse subjects:

Employees use digital platforms such as webinars and e-learning courses and virtual conferences for their professional training.

- Healthcare operations in pharmacies achieve enhancement through the implementation of e-prescriptions and digital dispensing systems.
- Impact of digital communication tools (Zoom, email automation, and AI-driven chatbots) on professional collaboration and customer interactions.
- The implementation of digital systems leads staff to perceive increased work performance efficiency.
- Level of confidence and familiarity with new digital technologies in pharmacy management.

Anonymization processes on survey feedback protected employees from revealing their information while they gave unbiased statements. The study team performed an initial pilot test with fewer workers for enhancing the clarity of survey questions and making the language more straightforward(8).

Statistical and Analytical Techniques

The analysis involved using quantitative statistical approaches for survey data including descriptive statistics and trend analysis and comparative analysis from the three survey research cycles. Survival Query in SPSS and Microsoft Excel processed statistical data from survey responses by generating frequency counts together with percentage distributions and mean values for different survey questions. The research used Chi-square tests alongside t-tests to discover which attitude and behavior shifts over time demonstrated statistical importance. Open-ended answers received thematic analysis as part of qualitative interpretation through which researchers observed prominent patterns regarding digital adoption and its associated benefits or hurdles.

Ethical Considerations and Research Validity

The research followed fundamental ethical guidelines by getting participant consent freely while maintaining privacy throughout the study process. The participants received clear information about the research goals and methods in addition to expected results before being allowed to discontinue their participation at any time without negative effects. An ethical approval for the study came from the College of Business Economics and Entrepreneurship which is based in Belgrade to guarantee compliance with academic and ethical guidelines. The authors used multiple validity assessment techniques through survey data validation using published literature reports and pharmacy digital practice regulatory documents.

3.Results

Demographic Composition and Employee Perspectives on Digitalization

Research data was gathered from 23 staff members consisting of 10 pharmacists and 13 pharmaceutical technicians who are currently involved in digital pharmacy operations. Woman employees composed 83% of the total workforce according to demographic composition statistics and male personnel numbered at only 13% while one participant declined to provide their gender information. A diverse mix of professional profiles provided complete evaluation of digital pharmaceutical sector practices. Different age groups along with established and new professional employees took part in the study which let researchers monitor demographic-related digital tool interpretations and business stability perspectives. Survey results showed that workers from every professional area expressed high levels of digital adaptation interest thus proving continuous technological education and digital proficiency essential for current pharmacy operations. Participants from every profession found the connection of e-prescriptions and online sales platforms with digital communication tools to be advantageous since they all verified that digital transformation enhanced processes and improved accuracy and customer interaction(9). The six-month research period witnessed employees developing greater comfort levels in handling digital pharmacy tools when they moved from traditional to digital methods after facing initial doubts. Staff members adopted e-prescriptions and digital sales management systems because they reported benefits such as simpler access and diminished paperwork and accelerated delivery timing.

Digital Learning and Professional Development Trends

The main purpose of this research centered on understanding how digital education together with professional development affected the competitiveness and business resilience of pharmacies. Professional webinars and Zoom-based training sessions gained substantial support from respondents according to the study results because 81% attended webinars and 57% participated in Zoom-based training sessions. Pharmacists and technicians increasingly adopt online education because it lets them stay informed about changes in regulations and industry trends as well as technological developments. People performing work at Axo showed higher contentment with digital educational resources instead of conventional instructional practices because digital systems offered immediate access to study materials alongside interactive ways to study and chances to connect with industrial experts virtually. People in the survey strongly chose digital sources like e-Pharmacy (78%) instead of Pharmacy Practice journal print materials to acquire professional knowledge. Frequent digital learning activities by employees resulted in better digital pharmacy tool proficiency and higher work-related confidence. Results from the survey demonstrated enhancing digital engagement between testing sessions because more employees began using digital training resources throughout the study period. Digital education exposure enables pharmacy professionals to develop a positive outlook which helps them master digital skills needed for the changing digital world.

Impact of Digital Tools on Operational Efficiency and Consumer Experience

The research study focused on establishing the degree to which digital technologies improved operational speed and the patient experience of pharmacies. The survey showed improved productivity at the workplace through e-prescriptions because all participants confirmed these prescriptions decreased pharmaceutical errors while shortening administration processes and minimizing paperwork burdens. The adoption of internal digital dispatch notes together with automated inventory management systems created better pharmacy operations through accurate stock tracking and efficient order processing according to employee feedback. The introduction of online sales platforms proved to be a major advancement that allowed employees to report expanded access for customers to buy pharmaceutical products at their convenience through digital channels(10). The analysis considered how digital communication platforms using Zoom sessions and automated email alerts and artificial intelligence customer service technology boost consumer interactions. Employees who participated in the study unanimously approved the usefulness of internal digital documentation systems for pharmacy workflow management and Zoom meetings obtained similar approval from 57% of participants as essential for pharmacy competitiveness improvement. All discussions about e-commerce and digital prescription management yielded positive results that produced improved pharmaceutical services with faster processing and accurate delivery along with extra convenience for customers.

Business Resilience and Future Technological Adaptation

This research analyzed the vital impact which digital transformation has on business resilience enhancement. Organizational business resilience plans proved to exist in 91% of surveyed companies according to respondents indicating the significance of strategic digital preparedness for industry challenge navigation. Most employees understand digital adaptability as the foundation for long-term business stability and they recognize that digital development acts as an essential tool for partner collaboration through all supply chains and health care providers and regulatory interactions (78%). All survey respondents agreed on the need for ongoing technological innovation to safeguard the pharmacy sector since most workers showed positive attitudes toward employing emerging systems like AI prescription recommender technology and blockchain tracking systems and automated drug dispensing platforms. Employee reluctance toward digitalization transformed into acceptance as time passed according to investigation results thus demonstrating the necessity of sustained training programs and awareness initiatives to achieve digital success. Digital strategies backed by adaptable employees and continued IT investments form the foundation for pharmacies to develop resilient and competitive business operations within the fast-moving digital landscape.

4. Discussion

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The Role of Digitalization in Transforming Pharmacy Practices and Workflows

Digital technology integration for pharmacy operations drives operational efficiency while it improves customer satisfaction along with creating resilient business operations for pharmaceutical organizations. Digitalization has produced major functional changes that shifted pharmacies toward expert automated technology-driven approaches to replace traditional paper usage in business operations. The digitalization of prescriptions through e-prescriptions brought substantial improvements by making prescription fulfillment more efficient and diminishing both paper errors and ensuring better healthcare safety for patients. The electronic transfer of medical prescriptions from doctors to pharmacists through e-prescriptions reduces the dangers of unreadable handwriting as well as communication problems and file losses to provide exact medications on time. Pharmacists can make better prescription choices through real-time patient record and medication history access which stops medication errors and drug interaction problems as well as prescription abuse cases(11). Thorough pharmaceutical supply chain efficiency was enhanced by AI-driven pharmacy management systems together with automated inventory tracking tools that enable pharmacies to handle stock quantities with enhanced accuracy and minimize waste and adjust to market demand changes. Digitalized workflows now represent a global movement of healthcare digital transformation which uses technology excellence to increase patient care accuracy accessibility and accountability.

Professional Development and the Digital Learning Revolution in Pharmacy Education

Digital learning platforms combined with professional development systems represent a primary digitalization aspect in pharmacy operations through their transformation of knowledge acquisition for pharmacists and pharmacy technicians along with their regulatory and technical skill enhancement. Research evidence shows growing acceptance among pharmacy professionals toward webinars along with AI-assisted training materials and virtual conferences because these platforms give them flexible learning options that are more accessible than traditional classroom training. Digital learning platforms have gained popularity because the pharmaceutical sector expands rapidly with new medications, healthcare technologies and regulatory changes. The healthcare industry demands that pharmacy professionals seek updated information about recent industry developments through organized knowledge programs that use modern educational technologies to ensure patient safety and therapeutic success. Digital learning tools allow pharmacists to benefit from collaborative learning by connecting them with global experts through virtual discussions and knowledge-sharing forums where they can access abundance of online research materials. This study demonstrates that digital learning involvement directly improves workplace efficiency while boosting professional competence regarding digital platforms and enhancing overall pharmacy service standards.

Consumer-Centric Digitalization: Enhancing Patient Experience and Pharmacy Competitiveness

Digital transformation practices in pharmaceutical businesses directly lead to positive changes in customer satisfaction while improving both convenience and satisfaction levels. Digital tools specifically including online platforms and automated prescription services together with AI-driven chatbots facilitate pharmacies to deliver superior and personal treatments with enhanced efficiency while providing excellent consumer convenience. Online medication purchases together with virtual doctor meetings and automated prescription alerts highly engage patients especially elderly patients with chronic diseases and patients who have issues visiting physical locations due to mobility limitations. Digital communication through automated updates and live chat services has boosted pharmacy service speed while making assistance more accessible at all times for customers. AI-driven recommendation systems integrated into digital transformation allow pharmacists to give individualized drug prescriptions along with health product suggestions that create personalized pharmaceutical healthcare services. The digitalization-driven higher customer service standards improve medication adherence of patients and help decrease healthcare costs and lead to superior clinical results. The digitalization process has become a key driver in pharmacy competition improvement through the delivery of technology-based convenience services alongside fast delivery operations and smooth digital interactions which draw customers to an increasingly technology-focused healthcare market.

Building Business Resilience Through Digital Agility and Strategic Adaptation

Business resilience in the present digital economy exists as an intrinsic relationship with digital agility which represents a business's speed to adjust for technological progression and market regulatory changes and industry conditions. Pharmacies implementing structured business resilience plans containing digital transformation elements demonstrate better performance in industry challenges and operational continuity response against economic disturbances and marketplace pressures and unanticipated crises. The pharmacies implementing e-prescriptions with online sales channels and telepharmacy services performed best during COVID-19 lockdowns because these measures allowed them to serve patients through remote healthcare solutions. The investment in digitalization demonstrates its permanent business value as the principal force that enhances operational resilience. Pharmacies will optimize their digital transformation benefits by investing in constant workforce training as well as cybersecurity practices and flexible digital infrastructure elements that support ongoing technological developments. A sustainable digital healthcare system requires pharmacies and healthcare entities to work alongside technology vendors and regulatory bodies to establish such a system. Advantages in business sustainability will belong to pharmacies that actively implement developing technologies including blockchain-based prescription authentication combined with AI predictive analytics and IoT (Internet of Things) solutions for inventory control.

5. Conclusion and Future work

The findings of this study underscore the transformational impact of digitalization on the pharmaceutical industry, particularly in the areas of workflow optimization, business resilience, professional development, and customer experience enhancement. As the healthcare sector increasingly shifts toward technology-driven models, pharmacies must adapt by integrating digital tools and data-driven approaches into their operations. The results from the research conducted in Serbian pharmacies indicate that e-prescriptions, digital inventory management, and online sales platforms have significantly improved service delivery efficiency, accuracy, and patient satisfaction levels. The transition from traditional paper-based processes to automated digital solutions has not only reduced human error and administrative burdens but has also allowed pharmacists to allocate more time to patient consultation, medication management, and preventive healthcare services. A crucial takeaway from this study is that pharmacists and pharmacy technicians increasingly recognize the value of digital tools, as evidenced by the widespread participation in online training programs, professional webinars, and AI-assisted learning platforms. This shift in educational engagement reflects a broader industry-wide acknowledgment that continuous digital upskilling is essential for career advancement and enhanced service provision. Additionally, business resilience has emerged as a critical factor in pharmacy sustainability, with the study highlighting the importance of strategic digital adaptation in ensuring long-term operational stability, regulatory compliance, and market competitiveness. The role of artificial intelligence, blockchain technology, and telepharmacy services will continue to expand, offering new opportunities for pharmacy businesses to improve their service models, optimize supply chain management, and enhance consumer interactions. However, while digitalization presents numerous advantages, it also introduces challenges such as cybersecurity risks, technological adaptation barriers, and resistance to change among employees. Therefore, the study recommends that pharmacies implement structured digital training programs, robust cybersecurity frameworks, and seamless technology integration strategies to maximize the benefits of digital transformation while mitigating potential risks. Ultimately, this research provides strong evidence that embracing digitalization is not merely an option but a necessity for pharmacies aiming to remain competitive, resilient, and consumer-focused in the evolving digital healthcare landscape.

Future Work

While this study has provided valuable insights into the role of digitalization in pharmacy operations, future research should explore additional dimensions to further refine our understanding of digital transformation in healthcare. One key area of future study is the long-term impact of digitalization on pharmacy workforce dynamics, particularly how automation, AI-driven analytics, and machine learning algorithms influence the roles of pharmacists and technicians. As artificial intelligence continues to advance, it is essential to assess whether certain pharmacy tasks become fully automated, how job roles evolve, and whether new digital skill sets will be required to operate intelligent pharmaceutical systems. Additionally, further research should investigate the economic implications of digital transformation in pharmacies, including an analysis of return on investment (ROI) in digital infrastructure, cost savings from automation, and financial sustainability models for small and independent pharmacies. Given that digital tools such as blockchain and Internet of Things (IoT) devices are increasingly being tested in supply chain management and drug authentication, future studies should evaluate how these emerging technologies can further enhance pharmaceutical security, compliance, and fraud prevention. Another important avenue for future research is consumer adoption patterns and digital healthcare accessibility, specifically examining how patients across different demographics respond to telepharmacy services, online medication consultations, and AI-driven health recommendations. Since not all populations have equal access to digital literacy training and internet-based healthcare services, future research should assess potential digital healthcare inequalities and propose solutions to

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ensure inclusivity and accessibility. Furthermore, cross-regional comparative studies could provide valuable insights into how digital pharmacy transformations vary across different healthcare systems, economic environments, and regulatory frameworks, helping to identify best practices for global digital healthcare integration. Lastly, while this study focused on employee perceptions and operational efficiencies, future research should incorporate real-time data analytics to measure the quantifiable impact of digital tools on prescription accuracy, patient adherence rates, and overall pharmacy revenue growth. By exploring these avenues, future studies can contribute to a more holistic understanding of digital healthcare transformation, ensuring that technological advancements continue to enhance pharmaceutical care, business resilience, and patient well-being on a global scale.

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Conflicts of interest

The authors have no conflicts of interest to declare

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