

Research on the Path and Mode of Digital Economy Enabling the Development of Smart Hospital

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ABSTRACT

In the digital economy era, the development of smart hospitals has become a crucial direction in the healthcare sector. This paper explores the pathways and models through which the digital economy empowers smart hospital development. First, it clarifies the concept and characteristics of the digital economy to establish a foundation for subsequent research. Then, it analyzes empowerment pathways from three perspectives: improving planning and cybersecurity management technologies, optimizing medical management standards, and innovating healthcare service models. Subsequently, it elaborates on key models including digital technology applications, industrial integration, and policy support mechanisms. Finally, the paper concludes by emphasizing the significant driving force of the digital economy in smart hospital development, and advocates for hospitals to actively leverage digital economy to achieve high-quality growth.

KEYWORDS

Digital economy; Smart hospital; Enabling path; Enabling mode

1 Introduction

In today's era of rapid information technology advancement, the digital economy has become a primary driver of social and economic development. Regarding healthcare, digital economy applications have brought new opportunities and challenges to the development of smart hospitals. Driven by information technology, smart hospitals optimize medical resource allocation through digital means, enhance service quality and efficiency, and provide patients with more convenient, efficient, and personalized medical services. These advancements are crucial for advancing public health initiatives and improving national well-being. However, current smart hospital construction faces multiple challenges including data silos, weak internal-external connectivity, insufficient clinical coverage, limited technical capabilities and talent reserves, as well as issues related to information security, privacy protection, and inter-system integration of medical information systems. Therefore, further research on development pathways and models that empower smart hospitals through the digital economy holds significant theoretical and practical value for promoting their high-quality advancement.

2 Concept and characteristics of digital economy

The digital economy is an economic model built on digital technology. By integrating and innovating information and communication technologies, it digitizes, networks, and smartens information to drive comprehensive transformation of the economy and society. Supported by digital technology, it transforms accumulated data resources into independent production factors within the real economy, boosting output and efficiency. Its characteristics are diverse and feature-rich: big data applications like ride-hailing apps enable differentiated pricing through consumer data analysis; information becomes a crucial production factor with enhanced speed and reach due to digital infrastructure; global resource mobility is facilitated by networked internet dependency; intelligent capabilities and emerging technologies boost information processing and analysis; while platform-based, personalized, globalized, green, innovation-driven, data-driven, and inclusive features intertwine to collectively propel the development of the digital economy.

3 The path of digital economy enabling the development of smart hospitals

3.1 Improve planning and design and network security management technology

The development of planning, design, and cybersecurity management technologies stands as the cornerstone of smart hospital construction. During the planning phase, it is essential to establish a comprehensive information system encompassing electronic medical records, hospital information management systems, and medical imaging platforms. This digital infrastructure enables centralized management and sharing of healthcare data, providing integrated decision-making support to prevent misdiagnosis and missed diagnoses caused by information asymmetry. By creating intelligent medical equipment networks, seamless interoperability between devices is achieved, supporting telemedicine and

teleconsultation services while transcending geographical boundaries to extend high-quality healthcare access to more patients. Simultaneously, the development of a medical big data platform analyzes patient visits, disease progression, and resource utilization patterns, optimizing resource allocation and enhancing medical service efficiency.

In cybersecurity management, smart hospitals handle massive amounts of patient privacy data, making patient safety a critical priority. Establishing and refining information security protocols with clearly defined responsibilities and procedures is essential, including implementing access control systems and data backup recovery mechanisms. Strengthening information security technologies through encryption for patient data processing prevents unauthorized access during transmission and storage. Installing firewalls and intrusion detection systems (IDS) helps defend against external cyber attacks, ensuring patient information remains secure and confidential. This approach safeguards against damage, tampering, or leakage of network hardware/software and data, maintaining uninterrupted system operations and reliable network services.

3.2 Optimize the level of medical management

Traditional hospitals often face challenges such as uneven distribution of medical resources and low utilization rates. Smart hospitals, however, can optimize resource allocation through big data analytics and intelligent scheduling. By analyzing patient visit data, they can identify peak and off-peak periods across departments, allowing doctors to schedule appointments more efficiently. Additionally, predictive analytics based on big data can forecast equipment usage needs, effectively preventing resource waste.

Smart hospitals can enhance medical service quality and efficiency through intelligent devices and systems. The AI-powered pharmacy system enables automated medication dispensing, reducing patient wait times for medications. Surgical robots assist in operations, improving both precision and safety. Meanwhile, these smart solutions streamline healthcare processes while minimizing human interference.

Furthermore, strengthening talent development stands as a pivotal element in optimizing medical management systems. The establishment of smart hospitals requires robust support from information technology and intelligent technologies, which places significant demands on hospital technical teams. Hospitals should recruit and train medical professionals equipped with IT expertise, while providing specialized training in digital health systems like electronic medical records (EMR) and telemedicine to enhance clinical application capabilities. Establishing dedicated IT management teams tasked with overseeing hospital digital transformation and operational management will facilitate the smooth implementation of smart hospital initiatives, ultimately delivering higher quality and more efficient healthcare services to patients.

3.3 Innovating medical service models

In the context of "Internet + Healthcare", innovative services can be diversified. Family doctor services establish long-term stable partnerships with patients through internet platforms, providing comprehensive and continuous health management —. This not only allows regular monitoring of medication adherence and disease progression through video consultations for chronic patients, but also integrates smart wearable devices (such as blood pressure monitors and glucose meters) to obtain real-time physiological data. Once abnormal indicators are detected, immediate alerts are sent and treatment plans adjusted. This completely breaks the time and space constraints of traditional medical services, enabling elderly patients with mobility issues and those in remote areas to access professional medical care from home.

The hospital's self-developed health management app has been enhanced with improved functionalities. Beyond assisting patients in monitoring and managing health data, it generates personalized health reports based on users' age, medical history, and lifestyle habits. The app provides dietary recommendations, exercise plans, and vaccination reminders while offering convenient features like online payments, report inquiries, and appointment scheduling. This allows patients to stay informed about their health status without visiting the hospital, significantly reducing time costs during medical procedures.

The intelligent management system has demonstrated remarkable effectiveness in optimizing healthcare resource allocation. For instance, its smart scheduling module automatically generates optimal work schedules by analyzing doctors' specialties, patient volumes, and rest periods. This intelligent system efficiently coordinates medical staff schedules and treatment tasks, preventing both overwork and underutilization of resources. Additionally, it provides real-time monitoring of outpatient and inpatient department operations, dynamically allocating beds and medical equipment to enhance resource efficiency and elevate healthcare service quality.

The advantages of online consultation and telemedicine services are equally significant. Through integrated communication formats combining text, images, and voice, these platforms enable patients to consult specialists about health concerns without waiting in line, effectively alleviating pressure on hospital outpatient departments. Most platforms guarantee "response within 30 minutes," ensuring timely patient feedback. Telemedicine specifically serves

patients with common or chronic conditions requiring follow-up visits, allowing them to receive medical care from home. Doctors utilize telemedicine technology to conduct detailed symptom assessments via HD video and voice calls, combine electronic medical records with health data to issue digital prescriptions, provide guidance on medication usage, dosage, and precautions, while also formulating personalized rehabilitation plans. This truly achieves precise delivery of tailored treatment recommendations. Additionally, some internet-based healthcare platforms have established cross-hospital collaboration mechanisms. When a patient's condition exceeds the capabilities of their attending physician, they can quickly connect with senior hospital experts for remote consultations, securing optimal treatment opportunities for patients.

4 The main modes of digital economy enabling the development of smart hospitals

4.1 Digital technology application mode

The application of digital technologies has played a pivotal role in advancing smart hospitals, spanning multiple cutting-edge technological domains. Intelligent diagnosis, powered by AI and big data-driven medical imaging systems, enables precise disease identification, provides diagnostic recommendations, assists physicians in making accurate judgments, and enhances diagnostic efficiency and accuracy. In healthcare management, wearable devices and mobile apps enable real-time monitoring of heart rate, physical activity levels, and other physiological indicators. This empowers users to better manage their health status, ultimately achieving disease prevention and early intervention goals.

The application of digital technologies in education also provides valuable references for cultivating talent in smart hospitals. Distance education and online learning platforms utilize internet technology to remotely deliver educational resources and services, enabling students in rural areas to access high-quality educational materials. These resources can be applied to remote training and continuing education programs for healthcare professionals in smart hospitals. With the support of cloud computing and the Internet of Things (IoT), digital educational resources can be intelligently matched and recommended. Hospitals can provide customized learning materials and training courses tailored to address healthcare workers' knowledge gaps and specific learning needs.

4.2 Industrial integration development model

The industrial development integration model illustrates how diverse sectors synergize through cross-sector collaboration to create new industrial ecosystems. This paradigm demonstrates multifaceted integration, innovation, and openness. Grounded in theories of industrial organization, regional economics, and growth dynamics, it is driven by technological innovation and diffusion, with policy frameworks and institutional mechanisms serving as its foundation.

The integration of industrial chains, value chains, and innovation chains constitutes the core significance of industrial convergence. Within industrial chains, upstream and downstream enterprises collaborate through joint innovation, sharing resources and risks to enhance overall competitiveness. In value chains, companies maximize value through coordinated processes of value creation, distribution, and realization. Across innovation chains, multiple industries work together to drive technological advancement and elevate industrial capabilities.

Industry convergence can be categorized into traditional and emerging sectors, as well as complementary industries, based on their nature. The integration process can be divided into initial and intermediate stages according to its progression. This development is jointly driven by technological advancement and market demand: technological progress enables seamless integration across industries, while market needs propel business consolidation and innovation. Looking ahead, we can anticipate deeper industrial convergence. The deepening of business integration will catalyze new business models and industrial chain formations, while expanded market integration will unlock fresh commercial opportunities and meet evolving consumer demands. Meanwhile, industry convergence remains dynamic, requiring timely tracking and adjustments. This process occurs within an open market environment, necessitating collaboration and communication among diverse industries and enterprises.

4.3 Policy support and guarantee mode

In the development of smart hospitals, policies serve as strategic guides and macro-level directives, clarifying development directions and objectives while providing clear pathways. Policy support attracts more capital, technology, and talent to the smart hospital sector, accelerating its construction. For instance, fiscal subsidies and tax incentives help alleviate funding pressures for hospital IT infrastructure and equipment procurement, while motivating tech companies to collaborate with hospitals in advancing medical IT innovation. Additionally, policies lead in establishing unified smart healthcare technical standards and data interface specifications, addressing "information silos" between different hospitals and systems. This includes standardizing electronic medical record formats and mutual recognition of test

results, enabling efficient information flow across hospitals to avoid redundant examinations. Such measures not only enhance medical efficiency but also reduce resource waste.

The policy framework ensures equitable access to smart hospitals while reducing disparities between regional and institutional scales through targeted support, enabling greater patient access to convenient, high-quality medical services. Concurrently, governments must establish comprehensive legal frameworks to define smart hospitals' legal status, service scopes, patient rights protection, standardized practices, and legal safeguards. Particularly in data security, policies should establish clear boundaries for medical data collection, storage, and usage, requiring hospitals to implement graded protection systems to prevent data breaches and fortify security defenses for smart healthcare. Moreover, medical insurance policies play a pivotal role. Integrating innovative smart hospital services into insurance coverage can alleviate financial burdens, enhance accessibility, and expand adoption rates. For instance, including telemedicine consultations and internet-based nursing services in insurance reimbursement lists effectively encourages patients to adopt smart healthcare solutions, transitioning the model from "pilot adoption" to widespread implementation.

In talent development strategies, priority should be given to enhancing training programs for healthcare professionals with expertise in information technology and intelligent systems. This ensures sustainable growth of smart hospitals through robust talent pipelines. Policy initiatives could drive the establishment of integrated "healthcare + IT" talent ecosystems. For instance, medical schools could develop specialized smart healthcare tracks, while collaborating with tech firms to deliver on-the-job training covering AI-assisted diagnostic systems, medical big data analytics, and intelligent service process optimization. Concurrently, implementing performance-based incentive mechanisms would recognize outstanding teams and individuals in smart healthcare innovations. Such measures will motivate healthcare workers to proactively adopt cutting-edge technologies, ultimately building a stable and high-caliber workforce for smart hospital development.

5 Conclusion

The digital economy has created new opportunities and momentum for the development of smart hospitals. This paper explores approaches to enhance planning design, cybersecurity management, medical service optimization, and innovative healthcare models. The application of digital technologies, industrial integration, policy support, and regulatory frameworks have effectively promoted high-quality development in smart hospitals. However, challenges remain including insufficient technical talent reserves, complex information security protection, and inefficient system interoperability. Hospitals need to strengthen multi-party collaboration, increase investment and planning, and cultivate professional talent. Governments should also enhance policy safeguards and improve regulations. Only through these measures can we ensure sustainable and healthy development of smart hospitals, ultimately delivering high-quality medical services to the public.

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