

Construction and Practice of an Intelligent Financial Management System: From the Perspective of Digital-Intelligent Transformation of Public Hospitals

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Abstract: Against the policy backdrop of in-depth advancement of new medical reform and full-scale implementation of DRG/DIP payment models, public hospitals are confronted with overlapping pressures including rigid budget constraints, refined full-cost accounting, and compliance risk control. Combining case analysis and path sorting, this paper systematically analyzes the construction process and effects of the intelligent financial management system for public hospitals. Practical results demonstrate that the system effectively addresses the pain points of traditional financial management in hospitals, markedly improves financial operation efficiency and scientific decision-making, and strengthens cost control and risk prevention capabilities. This study fills the research gap in scenario-based intelligent finance practices within the public sector and provides a set of implementable and replicable practical paradigms for the digital-intelligent financial transformation of public hospitals.

Keywords: Public hospitals; Digital-intelligent transformation; Integration of business and finance

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1. Introduction

The deep integration of digital-intelligent technologies and the healthcare sector is reshaping the operation model of the medical industry and has become a core driving force for modernizing the governance system of public hospitals. With the thorough rollout of DRG/DIP payment reforms and increasingly stringent requirements for high-quality development of public hospitals nationwide, hospital operation models have undergone dramatic changes. The focus of financial management has gradually shifted toward strategic decision-making, overall planning, and value creation. Such transformation brings unprecedented challenges

in massive data integration, intelligent decision analysis, and risk identification. Meanwhile, iterative upgrades of artificial intelligence, big data, cloud computing, and other digital-intelligent technologies have laid a solid foundation for breaking business-finance information barriers, reconstructing financial processes, and optimizing decision-making mechanisms. Technology empowerment enables automation and intensification of financial work, rendering intelligent finance a cutting-edge research direction for accounting theories and practices exploring value creation in the public sector.

Public hospitals are currently in a critical stage of high-quality development. Despite favorable technological conditions, they are generally plagued by fragmented business-finance data, insufficient granularity of cost accounting, delayed risk early warning, and other management deficiencies, which directly restrict the improvement of financial efficiency. Against this background, this paper adopts the digital-intelligent financial transformation of public hospitals as the analytical perspective. Combined with the construction case of the financial management system in Hospital T, it comprehensively interprets the system design ideas and core modules, and verifies its effects in financial management, decision support, and risk prevention. The research aims to explore an implementable intelligent finance model adapted to the operation and management of public hospitals, offer theoretical references and practical experience for the medical industry to upgrade financial governance capacity and achieve high-quality development, and further expand the theoretical boundary of government accounting research under the digital-intelligent context.

2. Research status

Digital-intelligent financial transformation has become a hot research topic, and financial informatization is an inevitable path in financial transformation^[1]. Chen *et al.* analyzed the application of artificial intelligence in financial management from three dimensions: refined management, risk control, and decision-making^[2]. Cheng proposed an integrated model combining intelligent agents with financial management^[3]. Sun put forward the utilization of big data technology to integrate various hospital systems^[4]. Zhao and Zhao respectively pointed out that the development of big data-driven finance is accompanied by a series of challenges^[5,6]. Financial reimbursement constitutes the most critical and widely covered module throughout the transformation process, and traditional manual reimbursement can hardly meet the demands of refined management^[7,8]. From the perspective of stakeholders, Xu conducted demand analysis on all participants involved in the reimbursement process and found that optimization and upgrading should be carried out from three dimensions: institutions, informatization, and personnel^[9]. Although most hospitals have launched or completed financial informatization reforms, problems such as data silos and delayed decision-making still persist^[10,11]. Yang *et al.* stated that digital-intelligent financial transformation needs to match hospital development goals, business logic, and practical financial application scenarios through diversified capabilities^[12]. Liu proposed to focus on the application scenario matrix to tackle the key difficulty of low implementation efficiency in digital-intelligent transformation^[13]. Deep integration of business and finance, together with full utilization of AI tools to analyze and control cost management and medical insurance expense control, can facilitate the construction of a full-process intelligent financial system and boost sound and high-quality development of hospitals^[14,15]. Existing research fails to adapt to the dynamic balance between operational efficiency and public welfare objectives of public hospitals, and there are few practical paths tailored to the medical industry. Therefore, it is evidently necessary and urgent to build an intelligent financial management system compatible with the characteristics of public hospitals.

3. Pain points of traditional financial management in public hospitals and demands for digital-intelligent transformation

3.1. Core pain points of traditional financial management in public hospitals

3.1.1. Fragmented business and financial data with prominent information silos

The operation of public hospitals involves multiple independent systems covering medical supplies, medical insurance finance, and other fields. Inconsistent data interfaces and standards across systems have formed severe information silos. The financial department cannot synchronize data with front-end businesses in real time and can only obtain post-hoc accounting data, which prevents full-process financial supervision over businesses and fails to unlock the asset value of data.

3.1.2. Incomplete closed-loop budget management with formalized execution control

Traditional budget management emphasizes budget compilation while lacking robust supervision over subsequent implementation. Disconnection between budget execution and departmental performance weakens the resource coordination function and leads to low capital utilization efficiency.

3.1.3. Extensive cost accounting hindering refined management

Traditional cost accounting is mostly limited to hospital-wide statistics, lacking data support for accounting at departmental, project, and DRG group levels with coarse granularity. Asynchronization between medical material consumption and financial cost carry-forward results in delayed cost accounting. Under the DRG/DIP payment model, manual calculation of disease group costs and profit-loss analysis suffers from low efficiency and poor accuracy, failing to satisfy cost control requirements under medical insurance payment mechanisms.

3.1.4. Lagging decision support and low efficiency of operational analysis

Financial data serves merely as the end product of management decision-making under traditional financial management models. Long-term reliance on post-hoc analysis of historical data makes management lag behind business demands. Fragmented data and complicated integration processes, coupled with over-reliance on manual experience and subjective judgment in business-finance integration, deprive decision-making of sufficient data support and hinder accurate financial forecasting and resource allocation.

3.2. Practical demands for digital-intelligent financial transformation of public hospitals

Targeting the pain points of traditional financial management and combined with the public welfare attributes of public hospitals, digital-intelligent financial transformation is an inevitable trend, with four core practical demands as follows:

- (1) Data integration demand: Break system barriers and aggregate fragmented data from various independent systems;
- (2) Refined management demand: Realize full-process refined management covering budgeting, costing, operation, and decision-making;
- (3) Intelligent decision-making demand: Build visual dashboards based on data to provide a factual basis for management decisions;
- (4) Deep business-finance integration demand: Promote connection between business and financial processes and facilitate the functional transformation of financial departments.

4. Construction and application effect of intelligent financial management system in Hospital T

4.1. Basic overview of Hospital T

Hospital T is a Grade A tertiary general hospital integrating medical treatment, teaching, scientific research, disease prevention and healthcare. As a regional medical center, it has nearly 1,000 open beds, more than 40 clinical and medical technology departments, an annual outpatient volume exceeding 850,000 visits, and over 35,000 annual inpatients. In recent years, with the full implementation of DRG/DIP payment policies and normalized performance assessment of public hospitals, the hospital's traditional financial management has encountered core management problems including scattered business and financial systems, inconsistent data caliber, low budget execution rates, and rough cost accounting, which cannot meet the requirements of high-quality hospital development. To address deviations in operational management and decision-making, Hospital T launched the intelligent financial management system construction project in 2024. Taking digital-intelligent transformation as the starting point, the hospital reconstructed its financial management system to realize deep business-finance integration, full online control, and intelligent decision support.

4.2. Construction objectives and principles of the system

Centered on the core philosophy of “data-driven, process optimization, and value creation,” the system connects interfaces of HIS, charging, medical supplies, pharmaceutical, medical insurance, and financial systems to integrate data resources and build a visual financial data platform. It drives the transformation of financial management from traditional accounting to strategic support, and comprehensively improves the hospital's financial management capacity and overall operational benefits.

4.3. Overall architecture design of the system

The intelligent financial management system of Hospital T adopts a three-layer architecture: Data Layer–Platform Layer–Application Layer.

Data layer: A unified hospital data middle office is built to interface with the HIS system, charging system, medical supplies management system, pharmaceutical management system, medical insurance settlement system, financial accounting system, and other platforms. ETL tools are adopted for data extraction, cleaning, conversion, and standardization to form a unified data resource pool that provides high-quality data sources for upper-layer applications.

Platform layer: Comprises a data governance platform and a model algorithm platform. The data governance platform unifies data dictionaries, verifies data quality, and maintains data updates; the model algorithm platform embeds cost allocation models, DRG profit-loss measurement models, budget execution monitoring models, and other algorithms to supply computational logic for various business modules.

Application layer: A real-time data display platform (management cockpit) is built for hospital administrators and department directors, realizing integrated management and intelligent control across five major scenarios: budgeting, contract management, reimbursement, costing, and decision-making.

4.4. Core functional modules of the system

4.4.1. Comprehensive budget management module

Targeting resource coordination and refined control of public hospitals, this module establishes a full-process closed-loop management system covering budget compilation, review and approval, execution monitoring,

adjustment and write-off, as well as analytical evaluation. A historical database is established to support data-based management, and the full online workflow of “department filling–centralized review–financial aggregation” is realized, forming a closed-loop control system covering pre-event planning, in-event supervision and post-event evaluation. The platform displays real-time progress and variance of budget indicators, enabling managers to grasp dynamic budget execution and address emerging issues in a timely manner.

4.4.2. Contract management module

Digitalized full-lifecycle control of economic contracts is realized, covering all types of payment and collection contracts. The system supports online drafting, review, signing, performance tracking, modification, filing and payment of contracts. It automatically links budget indicators with payment nodes to realize coordinated control of contract performance and budget execution. Risk early warning, contract ledgers and performance analysis help prevent contract performance risks and capital payment risks, improving the precision of financial control and risk prevention capacity.

4.4.3. Intelligent reimbursement module

Supported by OCR recognition, workflow engines and data linkage technology, the intelligent reimbursement module connects the full chain of pre-application, electronic invoices and automatic audit. Each expenditure is associated with corresponding budget items and capital sources to realize traceable whole-process capital management. Meanwhile, direct bank-hospital connection enables seamless linkage between approval and payment: payment instructions are sent to banking systems with one click upon approval, and payment status is fed back in real time. Vouchers are automatically generated and pushed to the accounting platform, allowing penetrating inquiry of business processes at any time node and providing comprehensive operational perspectives for leadership decision-making.

4.4.4. Full-cost management module

Based on full-process hospital operation management demands, a four-tier full-cost accounting system covering hospital-wide, departmental, project, and DRG group levels is constructed. Relying on the data middle office, the system automatically aggregates full-caliber cost data including personnel expenses, pharmaceutical and supply costs, depreciation and amortization, and operation and maintenance fees. Following the four-tier and three-category allocation principle, it accurately calculates departmental costs, medical service project costs, and DRG group costs. Meanwhile, multi-dimensional analytical charts of cost composition, fluctuation trends, and cost benefits are generated in real time to accurately identify high-consumption departments and abnormal cost nodes with intelligent early warning. It provides data support for hospitals to optimize resource allocation, control operating costs, improve diagnosis and treatment pathways, and conduct DRG profit-loss management, shifting hospital cost management from post-hoc accounting to full-process refined control.

4.4.5. Comprehensive operation decision-making cockpit

Serving as a visual command platform for hospital and department-level administrators, the cockpit deeply cleans, integrates, and models data scattered across isolated systems such as HIS, cost management, anesthesia, and SPD systems. Highly visualized charts present data intuitively, allowing administrators to overview the overall health status of hospital operations. Based on a multi-dimensional data middle platform, the system is vertically divided into hospital and department management perspectives, and horizontally covers four

major analysis fields including revenue-cost economic operation and special medical insurance analysis. It generates core charts on operational management such as operation reports, DRG cost analysis, and revenue analysis, converting raw data into actionable insights and decisions. It shifts hospital management from post-hoc experience-based judgment to pre-event prediction and in-process monitoring, realizing data-driven overall operation control.

4.5. Construction effect of the system

After deployment of the intelligent financial management system in Hospital T, data links between businesses and finance are effectively connected, shifting management from post-hoc accounting to pre-event declaration, in-event monitoring, and full-process traceability. Relying on the unified data middle office, information from multiple systems is integrated and shared with unified data calibers and standards, eliminating information silos and significantly improving the efficiency of data collection, processing and analysis. Financial departments have gradually transformed from traditional accounting units to management and decision-support departments.

In terms of budget management, integrated operation from compilation and execution to adjustment and evaluation is realized. After system launch, the budget compilation cycle is shortened from 50 days to 15 days, and data accuracy rises to 95%. The contract management module automatically links budget items and reimbursement platforms with standardized ledgers, standardized workflows, and timely early warnings, effectively preventing capital risks and performance hidden dangers during contract implementation. Supported by OCR recognition and automatic verification, the intelligent reimbursement platform greatly shortens approval time, with payment completed within one minute. Vouchers are automatically generated and pushed to accounting systems, realizing seamless connection among budgeting, reimbursement and accounting with tighter in-process control. Following the four-tier three-category allocation principle, the full-cost management module completes accurate aggregation and scientific allocation of hospital-wide, departmental, project and DRG costs, supplying reliable support for DRG profit-loss management, diagnosis pathway optimization and operating cost reduction. The comprehensive operational decision-making cockpit displays core indicators of hospital and department-level economic operation and cost benefits via visual presentations, realizing real-time dynamic monitoring on a single screen and providing timely, accurate and intuitive decision references for management.

Overall, the system aligns with the public welfare positioning of public hospitals and adapts to DRG/DIP payment and high-quality development assessment requirements. It comprehensively strengthens budget constraints, cost control, and comprehensive operational decision-making, markedly upgrading financial management efficiency and modernization of hospital governance, and forming a replicable digital financial construction paradigm for public hospitals.

5. Research conclusions and prospects

5.1. Research conclusions

Against the backdrop of the digital-intelligent transformation of public hospitals, this paper analyzes the pain points of traditional financial management and systematically sorts out the construction, implementation, and application effects of the intelligent financial management system based on the practice of Hospital T, drawing the following conclusions:

Under the policy environment of increasingly stringent performance assessment for public hospitals, traditional financial management fails to meet the demands of high-quality hospital development, making the construction of an intelligent financial management system practically necessary.

The intelligent financial management system for public hospitals must take a data middle office as the foundation, follow the principles of business-finance integration, data-driven operation, and compliance & practicability, and build five core modules including comprehensive budgeting, contract management, intelligent reimbursement, cost management, and comprehensive operational decision-making to precisely match the practical demands of hospital financial management and operational control.

Practice in Hospital T verifies that deployment of the intelligent financial management system can effectively break information silos, improve financial operation efficiency, strengthen cost and budget control, transform management decision-making from experience-driven to data-driven models, and elevate hospital financial governance efficiency, offering references for the digital-intelligent transformation of similar public hospitals.

System deployment is not merely a technological upgrade; it requires supporting optimization of management workflows and improvement of staff capabilities. Only coordinated advancement of technology and management can fully unlock the application value of intelligent financial systems.

5.2. Management suggestions

For individual public hospitals: first, consolidate the foundation of data governance and open interfaces of all business systems; second, focus on business-finance integration, promote deep connection between financial management and business workflows, and continuously optimize system functions according to practical business conditions.

For the medical industry as a whole: relevant authorities are advised to issue guiding specifications for intelligent finance construction and promote excellent practical cases to boost large-scale development of digital-intelligent financial transformation in hospitals.

5.3. Research limitations and future prospects

This paper only selects one public hospital as the research object, so the universality of its conclusions remains to be verified. Future research may conduct comparative studies across multiple hospitals to facilitate high-quality and sustainable development of public hospitals.

Disclosure statement

The author declares no conflict of interest.

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