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The Logical Interpretation, Practical Dilemma and Practical Path of Data Element Enabling the Transformation of Higher Education Governance

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Abstract: As a core production factor in the digital economy era, data elements are reshaping higher education governance systems through technological integration and institutional innovation. This study systematically analyzes the underlying logic of data-driven transformation in higher education governance, revealing practical challenges such as data silos, talent competency gaps, and rigid institutional efficiency. To address these issues, it proposes establishing a "data platform + scenario-based application" governance framework and enhancing institutional safeguards encompassing "governance architecture + security ethics + incentive mechanisms". Furthermore, building a talent pool combining "specialized teams + faculty-student collaboration" is essential for ensuring the sustainable advancement of data-driven governance reforms in higher education.

Keywords: data element; higher education; education governance; governance transformation

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1. Introduction

The modernization of higher education governance constitutes a vital component of China's national governance system and capabilities, bearing the strategic mission to fulfill the fundamental task of cultivating virtue and nurturing talents for the new era. In the digital age, data elements as emerging production factors are deeply integrated into higher education, profoundly reshaping governance concepts, models, and efficiency. This transformation presents a historic opportunity to break through traditional governance bottlenecks and enhance scientific precision in governance[1]. Focusing on the core proposition of "empowering higher education governance transformation through data elements," this study explores its internal logic from the disciplinary perspective of ideological and political education: Data-driven governance decision-making shifts from experience-based approaches to precision evidence-based methods, optimizing governance processes and efficient allocation of educational resources; Data connectivity evolves governance structures from bureaucratic fragmentation to collaborative co-governance, facilitating a comprehensive "all-staff, whole-process, all-round" educational framework; Data insights deepen understanding of faculty and student ideologies and developmental needs, reinforcing value guidance and the effectiveness of moral education[2]. However, current empowerment efforts face practical challenges: data silos remain unbroken, data literacy remains inadequate, data ethics and ideological security risks are prominent, and insufficient integration between data applications and ideological-political education objectives constrain the full realization

of data elements' potential. Clarifying these logical relationships, analyzing existing dilemmas, and exploring pathways hold significant theoretical and practical value for driving profound reforms in higher education governance systems, achieving organic unity between governance efficiency enhancement and educational goal attainment.

2. The logical interpretation of data elements enabling the transformation of higher education governance

The empowerment of data elements for higher education governance is not accidental, but stems from the deep convergence between their own characteristics and educational governance needs, as well as the synergistic effect of governance theory innovation and national policy promotion, forming a triple logical chain of characteristic adaptation, theoretical innovation and policy drive.

2.1. The characteristics of data elements are adapted

As a new production factor, data elements possess unique attributes that naturally align with the intrinsic needs of higher education governance, providing technical feasibility for governance transformation. Characterized by non-exhaustibility, replicability, and diminishing marginal costs, these data elements enable universities to correlate course evaluation data with student performance analysis[3]. This approach not only optimizes teaching strategies but also provides reference for course selection, achieving value-added benefits through "one-time collection, multiple reuse". Replicability breaks the time-space constraints of traditional information transmission, allowing high-quality educational resources (such as premium course recordings and research experiment data) to rapidly reach different campuses and departments, thereby reducing governance costs. Technically speaking, the high permeability of data elements allows deep integration into the entire governance process of teaching, research, and management. In teaching governance, learning analytics technology collects classroom interactions, assignment submissions, and online Q&A data to build personalized learning models, enabling "tailored" instructional interventions. In research governance, interdisciplinary data sharing platforms overcome disciplinary barriers, driving innovation in cross-disciplinary fields like artificial intelligence and biomedicine——. Tsinghua University's interdisciplinary data platform integrates research data from materials science and computer science, accelerating the application of novel algorithms in material simulation. This permeability restructures governance processes, transitioning from "coarse management" to "refined governance"[4].

2.2. Paradigm innovation of governance theory

The evolution from experience-based decision-making to data-driven governance has transformed higher education management theory from "bureaucratic governance" to "data-driven governance", addressing the core issues of information asymmetry and delayed decision-making in traditional systems. Traditional higher education governance, centered on bureaucratic structures, relies on top-down administrative directives and managerial experience, resulting in slow response times[5]. Student feedback and teaching challenges often require multi-level reporting before reaching decision-makers, missing optimal resolution windows. First, scientific decision-making: Comprehensive data replacing sampling enables shifting from "partial experience" to "holistic evidence". The developed "Department Development Evaluation System" integrates teaching quality, research output, and student employment data, generating evaluation reports through machine learning models that eliminate biases from traditional "subjective expert scoring", ensuring more precise resource allocation. Second, process transparency: Data tracking technology achieves "traceable and auditable" governance processes. Blockchain technology stores enrollment data, with all process records from application submission to admission notices recorded on the blockchain, effectively preventing data tampering risks[6].

2.3. Strategic opportunities driven by policies

The coordinated advancement of national strategies and educational reforms has been supported by institutional safeguards and strategic guidance from national-level policy design, which empowers data elements to enhance higher

education governance. This establishes a policy transmission chain of "top-level design-local implementation-university response". At the local level, education authorities have introduced supporting measures, including implementing the "University Data Governance Capacity Enhancement Plan" with special funding for provincial universities' data platform development, and establishing "Educational Data Circulation Pilot Programs" to explore mechanisms linking academic research data with corporate needs. These localized policies translate national strategies into concrete actions while reducing institutional costs in university data governance. On the university front, the synergy between policy incentives and technological progress has spurred governance innovations, enabling real-time decision-making in pandemic control, teaching arrangements, and other management scenarios. Through policy-driven university practices, the latent value of data elements is being transformed into governance effectiveness[7].

3. The practical dilemma of data elements enabling the transformation of higher education governance

Although data elements provide opportunities for the transformation of higher education governance, they still face multiple obstacles in practice, such as technology, system and culture. These difficulties are intertwined and form the practical difficulties of governance transformation.

3.1. Data islands and inconsistent standards: structural obstacles to governance coordination

The fragmentation of data and inconsistent standards within universities have created a critical governance challenge: the inability to form cohesive governance mechanisms for data elements. This predicament stems from the departmentalized nature of university administration[8]. Historically, academic institutions have operated in silos—academic affairs, research, student services, and finance departments each maintain separate information systems with incompatible formats and closed interfaces, forming "data silos." The lack of unified standards has exacerbated this isolation. Data collection protocols vary widely across institutions: some use student ID numbers as identifiers while others employ national ID numbers; definitions of "core journals" differ significantly between universities. Although high-quality data is essential for realizing data elements' value, current university data suffers from an imbalance between quantity and quality—vast volumes exist but poor quality undermines decision-making reliability, leaving governance still reliant on empirical judgments[9].

3.2. Talent ability gap: the human resource bottleneck of governance transformation

Empowering governance with data elements requires interdisciplinary talents combining technical expertise, educational background, and managerial skills. However, universities currently face a dual challenge of talent shortages and competency gaps, creating a critical human resource bottleneck for governance transformation. Regarding technical personnel, data governance teams at universities suffer from both quantitative scarcity and quality deficiencies. Most members possess only computer science backgrounds with limited experience in educational governance, while professionals proficient in advanced technologies like machine learning and privacy-preserving computation remain scarce. This results in massive amounts of data lying dormant on servers, unable to support governance decision-making. From a managerial perspective, administrative staff demonstrate inadequate data literacy. Many university administrators still rely on "first-guessing" decisions, lacking sensitivity to data nuances and analytical capabilities. In terms of faculty-student engagement, data literacy education remains insufficient. Students often exhibit weak awareness of personal data protection, casually disclosing campus account information, while teachers lack proficiency in applying technologies such as learning analytics and educational data mining, hindering the integration of data elements into teaching governance frameworks[10].

3.3. Institutional rigidity: institutional obstacles to governance coordination

The mismatch between traditional management systems and data governance demands has resulted in inefficient interdepartmental collaboration and a lack of incentive mechanisms, which hinders the realization of data elements 'value.

In terms of governance structure, the "multiple heads of management" issue in data governance remains prominent. Data operations in most universities are fragmented across multiple departments such as the Information Technology Center, Academic Affairs Office, and Research Office. The IT Center handles technical maintenance, the Academic Affairs Office manages teaching data, and the Research Office oversees research data, lacking a unified coordinating body. This "fragmented management" leads to difficulties in standardizing data and establishing sharing mechanisms. Regarding incentive mechanisms, there's a lack of interest balancing in data sharing. Departmental data is treated as "private resources" —sharing may increase workload without corresponding rewards, resulting in low willingness to share. In evaluation systems, data governance effectiveness remains excluded from assessment criteria. Universities still primarily evaluate departments based on traditional metrics like "teaching task completion rates" and "research funding allocation," while data governance contributions go unquantified. This disconnect leaves grassroots units lacking motivation to drive data governance initiatives[11].

4. Practical path of data factor driving the transformation of higher education governance

To solve the above dilemma, it is necessary to make concerted efforts from three dimensions: technical architecture, capacity building and system design, so as to build a new data-driven, multi-coordinated, intelligent, efficient, safe and controllable governance ecology for higher education.

4.1. Technical architecture: Build a governance technology system of "data center + scenario application"

To break down data barriers through technological innovation, we implement a full-process design of "standardized collection-centralized storage-intelligent application" to unlock the governance value of data elements. First, establish unified data standards and resource catalogs, developing university-specific data standards that define collection fields, formats, and update frequencies for core data such as student records, faculty profiles, course materials, and research outputs. Second, build a university-level data platform that integrates departmental systems into a three-tier architecture of "data lake-data warehouse-data service": The data lake stores raw data, while the data warehouse cleanses, correlates, and consolidates it. Third, promote intelligent application scenarios. Develop smart tools for different governance needs: In teaching management, create a "learning alert system" that identifies students with learning difficulties through attendance, assignment, and quiz data analysis, then delivers targeted support resources. For research governance, establish an "academic innovation map" that identifies interdisciplinary research hotspots by analyzing citation patterns and collaborative networks[12].

4.2. Capacity building: build a talent team of "professional teams + teachers and students"

To address talent bottlenecks through capability enhancement, we will cultivate professionals, improve management skills, and strengthen faculty development to provide human resources support for governance transformation. First, we will establish a multidisciplinary data governance team. We will recruit interdisciplinary talents with expertise in "Educational Technology + Data Science" to reinforce the technical team of the data platform. Experts from teaching management and research administration will participate in data modeling to ensure technical applications meet governance requirements. Collaborative "Data Governance Joint Laboratories" with enterprises and research institutes will be established to leverage external intellectual resources. Second, we will enhance managers 'data decision-making capabilities. Data literacy will be integrated into leadership training programs through courses like "Educational Data Analysis" and "Data-Driven Decision Making", using case studies to improve managers' data interpretation and application skills. A "Data Decision-Making Demonstration Post" will pilot data dashboards in departments such as Academic Affairs and Research Office, requiring managers to cite data evidence in decisions and fostering a governance culture of "data-driven decision-making". Third, we will strengthen data literacy education for faculty and students. Undergraduate and graduate curricula will include "Data Ethics and Security" courses to cultivate data protection awareness. Teachers will receive "Learning Analytics Technology

Application" training to optimize teaching using course platform data[13]. Activities like data visualization competitions and governance case sharing sessions will motivate both faculty and students to actively participate in data governance.

4.3. System design: Improve the system guarantee system of "governance structure + security ethics + incentive mechanism"

To address collaborative challenges through institutional innovation, we provide systemic support for empowering data governance by clarifying responsibilities, standardizing practices, and incentivizing participation. First, establish a governance framework of "Party committee leadership, president accountability, and cross-departmental collaboration." Form a university-level Data Governance Committee chaired by the president, with members including heads of IT, teaching, research, and student affairs departments to coordinate data standardization, middleware development, and security protection. A dedicated Data Governance Office manages daily coordination and implementation[14]. Secondary colleges appoint data specialists to bridge the "last mile" of governance. This structure clarifies "who governs data and how," eliminating multi-agency management issues. Second, enhance data security and ethical standards. Standardize the entire data lifecycle from collection, storage, sharing, to destruction. Require encrypted storage of sensitive data and secure interdepartmental agreements for sharing[15]. Establish a data security emergency mechanism with regular vulnerability scans and drills. Third, create data-sharing incentives. Incorporate data sharing into departmental performance metrics, awarding bonuses to departments proactively opening data and actively participating in governance. Introduce a "Data Contribution Award" recognizing individuals excelling in data collection, cleansing, and application.

5. Concluding remarks

Empowering higher education governance transformation through data elements fundamentally represents a systemic revolution integrating technological evolution, institutional restructuring, and cultural reshaping. Its core value lies in leveraging massive, multidimensional, and dynamic data resources to transform governance models from traditional empirical judgments and coarse management to precise decision-making and refined operations. This aims to fundamentally resolve deep-seated issues in higher education governance such as delayed responses, inefficient resource allocation, and inadequate efficiency improvement[16]. The ultimate goal of this transformation is to establish a new governance ecosystem characterized by "data-driven decision-making and continuous process optimization," ensuring every major strategic deployment receives robust data support while every critical educational phase possesses dynamic adjustment and iterative refinement capabilities. However, the current transition faces significant challenges: cross-departmental and cross-system "data silos" hinder effective resource integration and value realization; there's a structural shortage of interdisciplinary talents with data literacy and governance capabilities (talent bottleneck); and new governance rules and collaborative mechanisms adapted to data element circulation and application remain underdeveloped (institutional lag). Looking ahead, the key to overcoming these obstacles lies in advancing three foundational initiatives: First, building a secure, efficient, and shared data infrastructure to provide underlying support for empowerment; Second, accelerating the establishment of a data governance system with clear responsibilities, incentive compatibility, and robust safeguards to break down institutional barriers; Third, systematically implementing data literacy and capability enhancement programs for administrators and faculty/students. Only through these measures can we clear bottlenecks and fully unleash data potential. The transformation of higher education governance is poised to unveil a transformative landscape: governance entities will achieve deeper multi-stakeholder collaboration, shifting focus from reactive responses to proactive risk prevention and predictive analysis. Educational management and services will emphasize personalized adaptation and targeted resource allocation, significantly enhancing the efficiency of talent development resources and student satisfaction. Ultimately, data elements will become the core engine driving modernization in higher education governance, propelling the entire system toward higher quality, greater efficiency, enhanced equity, and sustainable development. This evolution will establish crucial governance foundations for realizing the national strategy of building

China into an education powerhouse.

Disclosure statement

The author declares no conflict of interest.

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