Research on Data Governance Measures in Universities Under the Background of Digital Reform

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Abstract. University data governance has been playing an active role in education, teaching, research, development, management, and decision-making. In the context of education governance and big data, data governance has gradually become the focus of university digital campus construction and the way to show school governance ability. Firstly, the connotation and characteristics of university data governance are analyzed, and then the challenges faced by university data governance are analyzed based on data norms, data sources, data dimensions, data quality and data models, and then targeted implementation measures of university data governance are constructed. This research aims to promote the realization of the modernization of the higher education data governance system and governance capacity and provides a reference for higher education data governance under the background of digital reform.

Keywords: Higher Education; Data Governance; Digital Reform; Digital Campus.

1 Introduction

Promoting the digital reform of higher education is an important way to build a high-quality higher education system. Programmatic documents of China such as the "New Generation of Artificial Intelligence Development Plan", "China's Education Modernization 2035" and "Education Informatization 2.0 Action Plan" put forward important arrangements for promoting the new pattern of education governance. The "new model of education governance" supported by digitalization should be regarded as an important work goal of higher education informatization construction[1]. Building a stable, safe, robust, accurate and easy-to-monitor and manage university-level data comprehensive governance framework is a prerequisite for eliminating information silos, information flow, integration of university-level information data , and big data analysis.

In recent ten years, Chinese universities have successively established digital campuses and carried out active practices in the fields of data standards, master data,

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metadata, and data quality. In particular, many universities have made a tentative exploration in teaching affairs, online teaching, behavior management, the second classroom, and other practices. To give full play to the value of data, data governance has become an important work in the informatization of university education.

In developed countries such as Europe and the United States, university management has a high degree of informatization, and data governance is mainly based on a variety of professional information platforms for school management. The management method is not only a way for schools to serve, but also a way for schools to obtain detailed information, which has become the main support for university management. In the last ten years, the theoretical research of university management data governance has been increasing. At present, the research on data governance mainly focuses on the concept, content and related theories, and the data of a certain region. For example, Rene Abraham et al. (2019) proposed the major building blocks of data governance and decomposed them along six dimensions[2]. Nie Ruihua et al. (2017) researched on the framework of big data in basic education [3]. Zhu and Caliskan (2023) explored the current challenges of university reform and transformation in Europe and China [4]. Marina Micheli et al.(2020) shed light on four models emerging from the practices of these actors: data sharing pools, data cooperatives, public data trusts, and personal data sovereignty [5]. Through the analysis, the researches carried out by domestic and foreign scholars from different angles and aspects, whether starting from the ecosystem, governance culture, or governance framework and governance model, provide good support for the theoretical and practical research of university data governance.

Due to differences in focus and description, there are many different interpretations of the understanding of data governance. This paper proposes that university data governance is a series of standards, norms, governance processes, and corresponding security systems implemented to control and control university data, aiming to optimize the allocation of educational resources, realize comprehensive display and personalized analysis of information, highlight various data-driven decision support, predict the development trend of education, and highlight the importance of data analysis and decision making. How to systematically increase the use of data and fully mine data so that data governance can promote the rapid and efficient development of teaching management services in universities is the focus of the current construction of universities.

2 Methods

2.1 Problem Diagnosis

This paper summarizes the problems faced by data governance in universities into five aspects: data specification, data source, data dimension, data quality, and data model, and elaborates and analyzes the causes with specific examples.

(1) The Lack of Data Specifications Reduces the Integration and Sharing of Data

There are barriers and uneven development among system data. Some data in public databases is not obtained from authoritative departments but is cleaned and extracted from other related business systems. In addition, there are also difficulties in data fusion caused by delayed updates of data maintained by authoritative data. Such problems in data governance become obstacles to data integration and sharing. The analysis and utilization of data mining based on integration and sharing is even more difficult.

(2) Data Sources are Scattered, Increasing the Difficulty of Unified Management

With the rapid development and construction of university information technology, one of the links is the relevant traditional work to the online system operation processing. The resulting rapid increase and accumulation of behavioral data, emotional non-cognitive attribute data, and biometric data results in more decentralized data processing, making systematic management more ambiguous, and gradually forming a chaotic cycle between the subsequent construction and the pre-construction data sources.

(3) Incomplete Data Dimension and Lack of Global Data Governance

University global data is a multi-terminal data acquisition and connection, multi-party data convergence and fusion, multi-scene data mining, and application. The data dimension should cover not only the business system data in the traditional shared database but also the data in the non-shared library. For the specific business system, if the real data in the original table of the business system is not collected, the effective information cannot be guaranteed to enter the data warehouse. Only when global data is covered and data resources are needed, the data of the service system can be found in the data warehouse.

(4) The Data Quality is not High, Increasing the Difficulty of Data Supervision

Once there is a lack of data quality monitoring and management and insufficient information literacy required by application managers, the isolation of the system is the necessary process, otherwise, it may lead to almost all systems cannot operate scientifically and accurately, and the task of data analysis carried out on this basis is even more difficult to effectively guarantee the quality of data analysis.

(5) Insufficient Data Model and Low Availability of Governance Results

Database, data table, database field, data interface, data throughput, etc., are the scope of the underlying data investigation. In the stage of data analysis and presentation, the adoption of interactive methods, the selection of content information, and the presentation type of chart types all inevitably have subjective meanings [6]. Therefore, whether the model is adequate and applicable is directly related to the science and rationality of the data, which involves the social science category of formulating the corresponding logical relationship of the model.

2.2 Measures and Approaches

Based on the above theoretical analysis of university data governance, this paper attempts to build an analytical framework for university data governance under the background of digital reform in view of the specific problems currently faced. Figure 1 shows the analytical framework. The framework consists of four layers, namely, the data standard layer, the data platform layer and the data application layer. The standard layer establishes the authoritative standard system of university data governance; The platform layer describes three aspects: accurately capturing multiple decentralized university data sources, building a whole-domain integrated university data warehouse, and implementing in-depth university data supervision. The application layer discusses the application model experience of data governance achievements in universities. The implementation paths of university data governance are discussed one by one below.

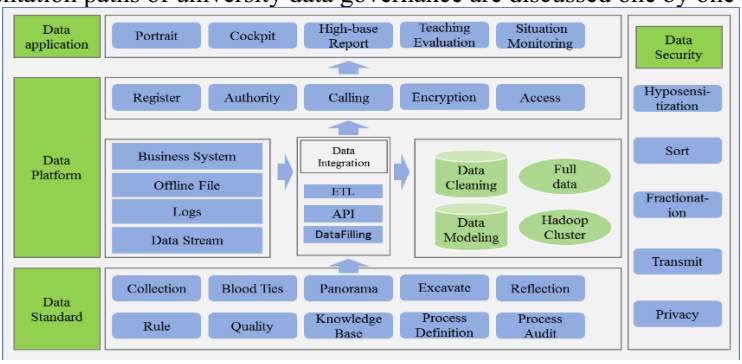

Fig. 1. Analysis framework of university data governance under the background of digital reform

(1) Establish an Authoritative Standard System for University Data Governance

This study sorted out the composition of the university data standard system, as shown in figure 2. The system should include information coding standard, unified identity authentication standard, data exchange standard and system subset information standard. Data governance standards need to be managed dynamically, laying the foundation for the comprehensive exchange and sharing of data. A unified data governance standard system to drive changes in the storage, access, update and dissemination of education management information. The central database of data governance is built according to the latest data standards, and the existing scattered data is extracted and converted into the central database through data governance integration tools, to finally realize data interconnection co-construction and sharing.

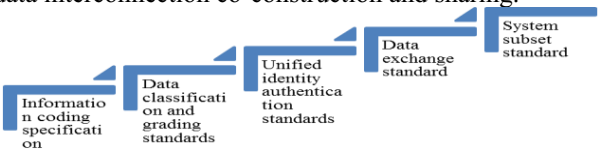

Fig. 2. Data standard composition chart

(2) Accurately Capture Multiple Decentralized University Data Sources

Data exchange technology is needed to capture data sources. The purpose of data exchange is to integrate scattered, disordered and inconsistent data in universities to provide an analysis basis for data quality management and monitoring. At the same time, the auxiliary collection method, that is, data reporting and collection, mainly collects basic teaching information and data through office file import, data form entry, data upload and other methods, and provides data verification, file format transformation, database field selection, various interfaces and other functions. Due to the variety of the system itself, the various ways to obtain, the diversity of the database, and the formation of the multiple complexity of the way to obtain data sources. The data source distribution is shown in Figure 3. Through the accurate collection of decentralized data sources and the capture of data information from each sub-business system, a large data center of a certain scale can be formed.

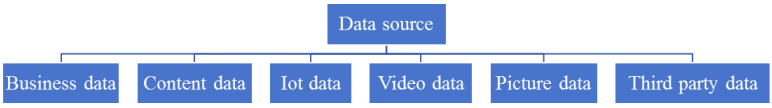

Fig. 3. Data source distribution map

(3) Build a University Data Warehouse with Global Integration

The university data warehouse should have rich sharing functions, expand the data service objects, realize the university's global data and full data sharing to a certain extent, and cover the whole life cycle management of university data. Metadata, master data and data warehouse form a fusion paradigm. The establishment of a data warehouse mainly adopts relational modeling and follows the distributed data exchange framework. A new data warehouse requires a unified database, unified field standards, unified extraction rules, integrated into a unified network topology deployment, etc., the data can be effectively related to form a true sense of the global integration of a university data warehouse.

(4) Implement in-depth University Data Supervision

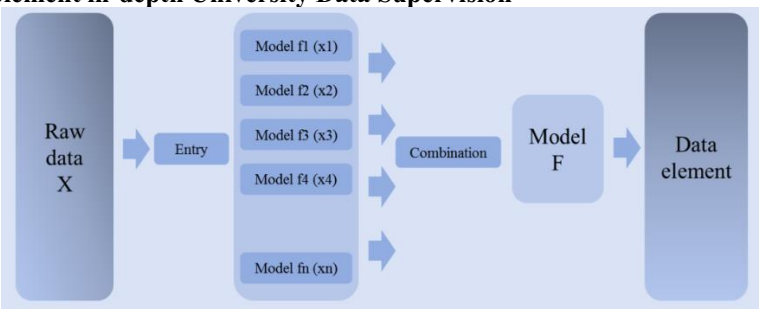

Fig. 4. Data processing and production

Data supervision covers the whole process of data processing and generation. During the phase in which source data becomes a data element, various types of models are generated, for example, through machine learning to generate various learning models [7]. Finally, all the models are merged into one big model. Each model is an application of the corresponding data. Supervision is needed in the generation of each model. The data processing and monitoring process is shown in figure 4. The data analysis model needs to have sufficient compatibility and foresight, including compatibility with the diversity of multiple data formats, and flexible expansion and extension of data warehouses. Through deep data mining, Echarts, FineBI, Vue and other tools are used to visualize user labels and data, achieve comprehensive viewing, inquiry, early warning, personalized needs, and other functions, and achieve multiple overall functional purposes of management and personalized customization goals.

(5) Optimize the Application Model Experience of Data Governance Achievements in Universities

The goal of university data governance is to carry out the application. The optimized content includes the display and monitoring of ordinary data, as well as the quality of shared experiences among multiple user groups, and the level of support from the school level for the development of the school. For example, a school table is constructed to evaluate the development and change of the school in multiple dimensions, a university table is constructed to scientifically judge the development trend of the university, and a teacher and student table is constructed to describe the portrait of teachers and students from the individual dimension. Good application experience is built on the foundation of sufficient security, and the governance of application experience also includes user data security, privacy security, and hierarchical data protection and storage. For example, data during the whole life cycle can be stored on the education blockchain, and analysis and evaluation can be carried out based on trusted data.

3 Conclusions

This study builds a targeted implementation path for university data governance. Through data governance, we can sort out and integrate the useful data generated in the operation of various systems, and provide basic data services for future data statistical analysis and deeper data mining, which is bound to help the rapid development of higher education and promote the modernization of higher education data governance system and governance capacity. With the development of educational information technologies such as cloud computing, blockchain, and 5G, the road to university education informatization is full of both challenges and opportunities. Universities should seize the opportunity of this wave, invest in data governance, and rely on data governance to help the comprehensive governance of schools. University data governance under the background of digital reform can not only strengthen the execution of data standards in campus information construction, make the sharing and integration between systems more convenient, but also simplify the configuration operation of data

exchange, improve the level of data application services, and form internal governance digitization.

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