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Research on the Construction of a Collaborative Governance Ecosystem for University and Community Volunteer Services Empowered by Big Data

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ABSTRACT
In the context of digital transformation, there is a significant contradiction between the spillover of university volunteer service resources and the embedded governance needs of communities. Traditional university-community cooperation models face fragmented dilemmas such as information barriers, mismatch between supply and demand, and singular evaluation methods. Drawing on ecosystem theory, this paper elucidates the internal mechanism by which big data, as a core element, empowers collaborative governance. It constructs a tripartite ecosystem model for volunteer service collaborative governance, encompassing technical support, subject reshaping, and mechanism operation. The study proposes that by perfecting top-level data design, establishing an integrated service middle platform, and improving multi-governance guarantee mechanisms, barriers between universities and communities can be effectively broken, achieving precise allocation of volunteer service resources and the co-creation of value.

KEYWORDS
Big data; University volunteer service; Community governance; Collaborative governance; Ecosystem

1 Introduction

Currently, with the deepening implementation of the "Digital China" strategy, emerging technologies such as big data and cloud computing are profoundly restructuring the logic and form of social governance. The application of big data in social governance embodies a people-centered governance philosophy, significantly enhancing the degree of alignment between public agendas and social demands [1]. University volunteer service, as a crucial vehicle for fulfilling the fundamental task of moral education and serving local economic and social development, has become a key link in advancing the modernization of grassroots governance systems and capabilities through its deep integration with community governance.

However, a scrutiny of current university-community cooperation practices reveals that despite the increasing frequency of interactions, deep-seated governance mechanisms still face numerous practical dilemmas. Universities possess abundant human and intellectual resources but often fall into the trap of resource idling or indiscriminate resource distribution due to a lack of precise docking channels. Conversely, community residents' service needs are becoming increasingly diversified and personalized, yet they are often constrained by information silos and supply-demand mismatches, leading to low service efficiency. The traditional volunteer service model, which relies on manual scheduling and extensive management, can no longer adapt to the requirements of high-quality development in the digital age [2].

Against this backdrop, exploring how to utilize big data technology to break down organizational barriers between universities and communities and achieve precise allocation and efficient collaboration of volunteer service resources holds significant research value. This paper aims to introduce the perspective of ecosystem theory to explore the internal mechanism of big data empowering the collaborative governance of university and community volunteer services. It analyzes current ecological stagnation and attempts to construct a collaborative governance ecosystem covering multi-subject symbiosis and full data integration, providing theoretical references and practical paths for promoting the digital transformation of volunteer services from unilateral supply to precise supply-demand matching.

2 Theoretical Basis and Logical Framework

Based on the intersection of ecosystem theory and collaborative governance theory, this study attempts to analyze how big data technology reshapes the interactive relationship between universities and communities in volunteer services, thereby constructing a logical framework for digital transformation.

2.1 Defining the Dimensions of the Volunteer Service Ecosystem

Borrowing the metaphor of natural ecology, university and community volunteer service is not an isolated linear interaction but a complex ecosystem interwoven by multiple subjects and elements. In this system, universities and university student volunteers are viewed as "primary producers," providing intellectual and human resources; communities and their residents play the role of "consumers," putting forward diversified service needs; social

organizations and volunteer service platforms undertake the function of "decomposers," responsible for demand mining, transformation, and secondary resource allocation [3]. Meanwhile, policies and regulations, community culture, and digital infrastructure collectively constitute the "ecological environment" on which survival depends. Traditional volunteer service ecosystems often suffer from system fragmentation and obstructed flow of energy and information. The core objective of constructing a collaborative governance ecosystem lies in breaking physical and logical barriers between subjects, realizing symbiotic evolution and dynamic balance of the system through the free flow of elements.

2.2 The Internal Mechanism of Big Data Driving Collaborative Governance

Collaborative governance theory emphasizes cooperative governance by multiple subjects in public affairs. However, restricted by information asymmetry and collective action dilemmas, collaborative effects have long been difficult to maximize. The intervention of big data technology reconstructs this logical rationale from three dimensions. First is the reshaping of connection logic. Through global sensing technology, big data digitally maps the scattered university supply side and the implicit community demand side, making implicit needs quantifiable and providing a data foundation for cross-boundary collaboration [4]. Second is the optimization of the matching mechanism. Relying on algorithmic power, the system can precisely identify supply and demand characteristics from massive unstructured data, promoting the transformation of volunteer services from traditional administrative assignment to intelligent matching, thereby reducing the transaction costs of collaborative governance. Third is the construction of a feedback closed loop. The real-time feedback mechanism of data flow can break the spatiotemporal limits of evaluation lag. Through credit profiling and service tracing, it compels the improvement of service quality, thus forming a positive circulation logic of "data empowerment—efficient collaboration—ecological optimization."

3 Realistic Scrutiny of Ecological Stagnation in Collaborative Governance

Despite the normalization of university-community pairing and co-construction, under traditional governance models lacking data technology support, the flow of various elements is obstructed. The system operation exhibits significant characteristics of "ecological stagnation," restricting the depth and efficacy of collaborative governance.

3.1 Blindness in Supply-Demand Docking Caused by Data Barriers

In the current volunteer service ecosystem, universities and communities belong to different administrative and information systems, forming insurmountable "data silos." Universities possess a vast volunteer database, including supply data such as professional skills and free time, which often settles in internal campus league affairs systems. Meanwhile, grid-based governance needs of communities, such as care for the elderly living alone and after-school tutoring, are scattered in the ledgers of sub-district offices or neighborhood committees. Due to the lack of unified data standards and interaction interfaces, information flow between the two parties is blocked. This severe information asymmetry directly leads to a mismatch between the "supply side" and the "demand side." Consequently, university student volunteers are left idle because they cannot find suitable projects, while communities in urgent need of professional services face the dilemma of "no one taking orders." Service docking often relies on manual communication, presenting characteristics of inefficiency, randomness, and blindness [5].

3.2 Fragmentation of Ecological Operation Triggered by Loose Collaborative Mechanisms

Due to the lack of overall scheduling by digital platforms, university-local collaborative governance often falls into a "fragmented" organizational dilemma. Current cooperation is mostly activity-oriented rather than governance-oriented, often limited to specific theme months or winter and summer social practices, showing obvious "campaign-style" and "assault-style" characteristics. The lack of full-lifecycle digital management means makes it difficult for volunteer services to form a normalized long-term mechanism. Connections between universities and communities are more often single-instance links based on personal relationships, without forming stable contractual relationships and functionally complementary "ecological niches." The fragmentation dilemma of loose multi-subject structures and partial collaboration restricts the exertion of governance efficacy [6].

3.3 Involution of Incentive Systems Caused by Lagging Evaluation Feedback

In the absence of big data profiling support, the evaluation system for volunteer services has long been trapped in the misconception of "duration-only theory." Current assessments mostly rely on simple accumulation of check-in duration, lacking multi-dimensional quantitative evaluation of service quality, service difficulty, and social impact. This extensive evaluation method not only fails to objectively reflect the true contribution of volunteers but also makes it difficult to form effective positive incentives. As a result, some volunteers fall into the formalism trap of serving merely to "rack up hours." The service process lacks emotional investment and value recognition, causing "spiritual energy" loss within the ecosystem, leading to a low retention rate of high-quality volunteer talent and difficulty in maintaining the sustainable development of the ecosystem.

4 Model Construction: A Volunteer Service Collaborative Governance Ecosystem Driven by Big Data

addressing the aforementioned ecological stagnation, this study constructs a tripartite big data collaborative governance ecosystem model consisting of technical support, subject reshaping, and mechanism operation. This model aims to achieve deep coupling of university-local resources and value co-creation through the full-cycle flow of data.

4.1 Technical Architecture: Building an Interconnected Digital Foundation

The construction of the ecosystem primarily lies in breaking physical and logical boundaries. Based on cloud computing and IoT technology, a "University-Community Volunteer Service Collaborative Cloud Platform" is established. At the data sensing end, mobile terminals are used to collect explicit data such as volunteer behavior trajectories and professional skills, while simultaneously capturing implicit data such as resident needs and public opinion hotspots from community grid management systems. At the data middle platform end, unified data cleaning and exchange standards are established to break the barriers between university academic affairs systems and street administrative systems, gathering into a standardized "University-Community Volunteer Service Special Database," providing flowing resource guarantees for the operation of the ecosystem.

4.2 Operation Mechanism: Achieving Precise Coupling of Supply and Demand

Relying on big data algorithms, the system reshapes the operational logic of volunteer services. First is precise matching of supply and demand. The system conducts multi-dimensional profiling of the university "supply side" (e.g., identifying professional background, free time slots, and communication skills) and simultaneously performs label-based analysis of the community "demand side" (e.g., tagging solitary elderly, companionship needs, or medical consultation characteristics). Through collaborative filtering algorithms, intelligent recommendation and automatic matchmaking of service projects and volunteer capabilities are realized, solving the problem of personnel-post mismatch [7]. Second is full-process dynamic supervision. LBS positioning and geo-fencing technologies are utilized to realize visual management of the service process. The system monitors service status in real-time and triggers early warning mechanisms in emergencies such as falls by the elderly or service disputes, ensuring the safe and stable operation of the ecosystem.

4.3 Value Evaluation: Establishing a Data-Driven Feedback Closed Loop

Changing the singular duration evaluation model, a multi-dimensional evaluation system based on big data is constructed. This system includes three dimensions: for the Community end, it supports residents in scoring service satisfaction in real-time via mobile terminals; for the Volunteer end, algorithms analyze service frequency, response speed, and mutual aid behavior to generate "volunteer credit points"; for the Society level, comprehensive assessment is conducted combining data on the social impact of service projects. Evaluation results are fed back into the system, serving as an important basis for university awards and community resource allocation, forming a benign ecological closed loop of "data accumulation—evaluation feedback—service optimization" [8].

5 Implementation Paths: Landing Strategies for the Big Data Empowered Ecosystem

To promote the transition of the collaborative governance ecosystem from a "theoretical model" to "practical application," efforts must be made synergistically from three dimensions: data governance, platform construction, and mechanism guarantees.

5.1 Perfecting Top-Level Design and Building a Standardized Data Governance System

Data standards are the prerequisite for ecosystem interconnection. Universities should take the lead in establishing a "University-Local Volunteer Service Data Governance Committee" jointly with local governments and communities to formulate unified standards for data collection, storage, and exchange. The focus should be on breaking administrative barriers and promoting data fusion between the university Youth League system and the community grid management platform. At the same time, a solid line of defense for data security must be built, establishing hierarchical and classified privacy protection mechanisms to de-identify sensitive data of volunteers and special community groups, ensuring data flows on a safe and compliant track.

5.2 Insisting on Technical Empowerment and Building an Integrated Collaborative Service Middle Platform

Centering on user experience, digital infrastructure should be iteratively upgraded. It is recommended to integrate existing scattered applications and develop a regional comprehensive volunteer service application terminal integrating "demand release, intelligent matching, process supervision, and performance evaluation." In terms of functional design, the construction of a "supply-demand cockpit" should be strengthened, utilizing large visualization screens to display regional volunteer service heat maps in real-time, providing an intuitive basis for management to make resource allocation decisions [9]. Additionally, blockchain technology should be introduced to record volunteer service duration, generating tamper-proof digital certificates to enhance data credibility.

5.3 Sounding Guarantee Mechanisms and Creating a Multi-Governance Ecological Environment

Technology landing requires institutional escort. First, a mechanism for mutual recognition of credits and incentives between universities and localities should be established, opening channels for exchanging volunteer service duration with second classroom credits and community points, and promoting the "Time Bank" mutual aid model to solve the "universal deposit and withdrawal" problem via digital means . Second, digital literacy training should be strengthened, conducting special skills training aimed at the shortcomings of community workers' ability to apply digital tools. Finally, risk prevention and control plans must be improved, utilizing big data early warning models to intervene in advance regarding safety hazards during the service process, ensuring the benign and sustainable operation of the collaborative governance ecosystem.

6 Conclusion and Outlook

Based on the background of educational digital transformation, this paper attempts to construct a collaborative governance ecosystem model for university and community volunteer services driven by big data. The research indicates that the intervention of big data effectively resolves the dilemmas of "information silos" and "mechanism fragmentation" existing in traditional university-local cooperation. Through mechanisms of precise profiling, intelligent matching, and dynamic feedback, it promotes a qualitative change in volunteer service resources from "physical assembly" to "chemical fusion," achieving a dual enhancement of governance efficacy and educational effectiveness.

Looking ahead, with the iteration of Artificial Intelligence (AI) and Large Language Model technologies, collaborative governance will evolve towards a deeper level of "smart governance." Future research should further focus on the balance between algorithmic ethics and humanistic values, exploring how to maintain the warmth and emotional connection of volunteer services while pursuing matching efficiency, avoiding the technical trap of "data-only theory." Meanwhile, breaking deep-seated institutional barriers and promoting the substantive fusion of cross-departmental data still requires continuous exploration in practice to build a more open, inclusive, and sustainable new ecosystem for volunteer services.

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