

# Data-driven Public Sports Service Supply: Theoretical Integration, Paradigm Shift and Future Directions

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**Abstract:** Data-driven public sports service supply faces theoretical tensions and practical dilemmas: New Public Management (NPM) prioritizes efficiency but risks data monopoly and privacy leaks; the Health Ecology Model (HEM) pursues precision and equity yet may exacerbate the digital divide; Sports Industry Economics (SIE) seeks a market-public balance but suffers from ambiguous data property rights. To address these paradigm conflicts, this paper proposes the "EPS Three-dimensional Integration Framework" (Efficiency-Precision-Sustainability), aiming to achieve dynamic balance among multi-dimensional values. Drawing on empirical evidence from Chinese practices (e.g., Zhejiang's "Zhe Li Fitness" APP, Xiamen International Marathon), the framework integrates NPM's efficiency orientation, HEM's precision logic, and SIE's sustainability pursuit. Results indicate that data-driven supply optimizes resource allocation (e.g., 20% higher venue turnover in Chengdu) and enhances service personalization, but requires addressing data silos, talent shortages, and digital inequities. The EPS framework and its derived government role transformation (from "data controller" to "agile governor") provide actionable insights for public sports service innovation in the digital era.

## 1. Introduction

Digital transformation has emerged as a core agenda item in the governance of public sports services worldwide, while its advancement has long been trapped in the enduring tension between operational efficiency and social equity. Traditional single-subject supply models are plagued by dual market and government failures: government-dominated service provision is often constrained by bureaucratic inflexibility, whereas market-oriented reform efforts frequently result in unbalanced allocation of public sports resources [1]. In China, a populous nation that is steadily advancing the "Healthy China 2030" national strategy, public sports services serve as a foundational pillar for improving national health outcomes and promoting the modernization of social governance. Nevertheless, multiple practical challenges remain to be solved—prominent urban-rural gaps in resource allocation, backward data infrastructure construction, and fragmented collaboration among multiple stakeholders have all become major obstacles to digital transformation in provinces such as Sichuan [2].

Current theoretical systems are unable to provide a systematic explanatory framework for the data-driven supply of public sports services: NPM places excessive emphasis on market efficiency, HEM pays insufficient attention to the universal accessibility of services, and SIE lacks a clear definition system for data property rights [3]. Against this backdrop, this study aims to fill two key research gaps in the existing literature: (1) How to effectively integrate conflicting theoretical paradigms in the research field of data-driven public sports services? (2) How to realize the coordinated balance of efficiency, precision and sustainability in practical service supply? By constructing the EPS three-dimensional integration framework and conducting an in-depth analysis of typical Chinese practice cases, this paper makes theoretical contributions to the integration of multi-paradigm research and provides practical references for policy formulation in this field.

## **2. Theoretical Evolution and Paradigm Conflicts**

### **2.1. New Public Management (NPM)**

The NPM theory advocates for the marketization of public services (represented by the PPP model) and the construction of an "entrepreneurial government", with the core goal of improving the operational efficiency of public service supply. However, the application of NPM in data-driven public sports services has brought notable potential risks. For instance, Zhejiang's "Zhe Li Fitness" mobile application, despite realizing the integrated management of fitness resources across the province, has set up a hierarchical membership system that gives priority to high-paying users, which has been criticized as a form of "data Darwinism" [4]. The PPP project of Singapore Sports City encountered a similar failure: private operators tripled the rental fees of sports venues, which effectively excluded most community residents from using the facilities [5]. These typical cases fully expose the inherent tension between the pursuit of market efficiency and the maintenance of public welfare attributes in public sports services.

### **2.2. Health Ecology Model (HEM)**

The core logic of HEM centers on the "interaction between individual behavior and the external environment", and it realizes the delivery of personalized public health services through continuous data monitoring (a typical example is the use of smart bracelets to track the health status and physical activity of elderly groups). However, the heavy reliance of HEM on digital technology has further aggravated social inequality in public sports service access. For example, rural pilot projects in Mianzhu City, Sichuan Province, encountered extremely low user adoption rates, which was mainly caused by inadequate local network coverage and the insufficient digital literacy of elderly residents in the region [6]. Without the support of universal digital infrastructure, precision-oriented services based on this model are at risk of degenerating into unrealistic "technological utopias".

### **2.3. Sports Industry Economics (SIE)**

SIE focuses on exploring the assetization and market circulation of sports data, with the aim of striking a dynamic balance between stimulating market vitality and safeguarding public interests. A typical case is Hangzhou's "Smart Asian Games One-Stop" platform, which integrated 28 categories of related services and accumulated more than 100 million registered users during the event. However, its core service functions were significantly reduced after the Asian Games, which was mainly attributed to unsustainable long-term operating costs and an unclear benefit distribution mechanism [7]. The public data authorization pilot project in Henan Province also encountered serious data abuse issues: relevant enterprises resold marathon participants' trajectory data to third-party institutions, which caused serious damage to public interests [8].

## **3. The EPS Three-dimensional Integration Framework**

### **3.1. Framework Construction**

To fundamentally resolve the conflicts between the above theoretical paradigms, this study constructs the EPS three-dimensional integration framework, which integrates three core value dimensions. The construction of the framework is based on the triple attribute logic of public sports services: as quasi-public "products" (corresponding to the efficiency dimension), as basic citizens' "rights" (corresponding to the precision dimension), and as long-term developmental "systems" (corresponding to the sustainability dimension). The core connotation of each dimension is as follows:

**Efficiency Dimension:** Drawing on the core logic of NPM, this dimension aims to optimize the allocation of public sports resources through cross-subject data sharing and market-oriented operation mechanisms. **Typical Practice:** Chengdu's "Sports Expert" mobile application has realized the unified integration of 138 sports venues in the city, shortening the average venue reservation time from 15 minutes to 2 minutes, and driving a 20% increase in the overall venue turnover rate.

**Precision Dimension:** Based on the service logic of HEM, this dimension focuses on realizing

the delivery of personalized public sports services through data-driven identification of users' diversified fitness needs. Typical Practice: The Xiamen International Marathon has adopted AI image recognition technology and real-time physical condition monitoring systems to provide differentiated event support and fitness guidance for participants with different age groups and fitness levels.

**Sustainability Dimension:** Inheriting the development concept of SIE, this dimension is committed to ensuring the long-term stable development of public sports services through the establishment of a data value cycle mechanism and equitable benefit distribution system. Typical Practice: Ningbo's "Sports Ningbo" integrated service platform has used the revenue generated from data-driven sports consumption voucher operations to provide stable financial support for the daily maintenance and upgrading of public sports facilities. To resolve theoretical conflicts, the EPS framework integrates three core dimensions, grounded in the logic that public sports services act as "products" (efficiency), "rights" (precision), and "systems" (sustainability):

### **3.2. Theoretical Repositioning**

#### **3.2.1. Data Elements as "Relational Right Bundles"**

Under the EPS framework, sports-related data (including individual exercise behavior data, venue operation data, and sports event organization data) is redefined as a relational bundle of rights. The core rights and interests of each subject are clearly defined in this system: citizens, as the producers of original sports data, enjoy the right to share the benefits generated by data application; enterprises, as the developers and operators of data systems, obtain the right to compliant development and utilization of data resources; while governments, as representatives of public interests, retain the statutory supervision power over the entire data circulation process [9]. On this basis, this study proposes a "dual-circulation" management system for sports data: the internal circulation covers the whole process of data standardization, cleaning and in-depth analysis, while the external circulation includes government supervision and market feedback adjustment, so as to realize the dynamic balance between data openness and regulatory restraint.

#### **3.2.2. Government as "Agile Governor"**

Under the guidance of the EPS framework, the core role of the government needs to be transformed from a traditional "data controller" to a modern "agile governor", which requires the government to build three core governance capabilities:

**Dynamic supervision and authentication capability:** The government should implement differentiated supervision strategies, strengthening full-process monitoring in emergency scenarios (such as venue flow control during public health emergencies) and appropriately reducing the intensity of supervision in daily stable operation scenarios.

**Multi-objective coordinated balance capability:** It is necessary to use algorithmic tools to establish an automatic fairness compensation mechanism, a typical practice of which is reserving 20% of public sports venue time slots for offline users who are not familiar with digital operations.

**Flexible rule system construction capability:** The government should classify sports data into three levels: core data, important data and general data (referring to the classification guidelines formulated by Chengdu City), and formulate differentiated management rules for each level, so as to strike a balance between data security protection and data resource accessibility.

**Sustainability Risks:** Short-term policy support and unclear benefit distribution threaten long-term operation (e.g., Hangzhou's post-Asian Games platform shrinkage).

## **4. Future Directions and Policy Implications**

### **4.1. Priority Research Areas**

Based on the practical application and theoretical expansion of the EPS three-dimensional integration framework, the priority research directions in this field in the future can be systematically carried out around multiple core dimensions. In terms of data security and privacy

protection, it is necessary to further develop encryption and access control technologies, and establish a sound legal and regulatory system for sports data protection with reference to mature international regulatory systems such as the EU's GDPR [10]. For algorithm optimization, it is essential to integrate machine learning technologies to improve the prediction accuracy of public sports service demand and potential operational risks, while strengthening the governance of algorithmic bias to ensure the fairness and rationality of algorithm application in public service scenarios [11]. On this basis, in-depth interdisciplinary collaborative research among sports science, computer science, public management and other disciplines should be vigorously promoted to form cross-field research synergy, so as to effectively solve the complex practical dilemmas in the data-driven supply of public sports services [12]. At the level of service implementation and optimization, it is required to further refine multi-dimensional user portraits through multi-source data from social media platforms and professional sports service applications, so as to deliver more scientific and tailored fitness guidance services for different user groups, and continuously improve the supply capacity of precision personalized public sports services [13]. Meanwhile, a comprehensive, multi-dimensional performance evaluation index system for data-driven public sports services should be built, covering the three core dimensions of efficiency, precision and sustainability, to realize dynamic monitoring and continuous optimization of the effect of service supply. Finally, in-depth research on the multi-subject dynamic game model should be carried out, focusing on analyzing the behavioral interaction and dynamic game relationship among the government, enterprises and the public in the whole process of sports data circulation, clarifying the rights, responsibilities and interest demands of all subjects, and further optimizing the multi-stakeholder cooperation mechanism and benefit distribution system.

#### **4.2. Policy Recommendations**

Combined with the practical verification of the EPS framework in typical domestic cases and the priority research directions clarified above, this study puts forward phased, operable and targeted policy recommendations for the digital transformation of data-driven public sports service supply in China. For short-term policy priorities, it is necessary to accelerate the construction of a unified public sports data sharing and exchange platform, draw on the mature construction experience of Chengdu's public data open platform, and implement a standardized "one scenario, one authorization" data management model, so as to effectively break the widespread problem of data silos between different departments and subjects at the current stage. In the medium-term policy focus, the definition of sports data property rights should be clarified through special legislation, and a "public data social dividend fund" system should be established, which clearly stipulates that 30% of the operating income from public sports data is earmarked to support the construction and operation of grassroots public sports services, so as to fully guarantee the public welfare attribute and inclusive value of public data revenue. For the long-term strategic layout, it is required to establish cross-departmental agile governance coordination groups for public sports services to break down administrative barriers between different functional departments, and carry out pilot projects of trusted sports data circulation based on blockchain technology with reference to the construction experience of Hangzhou's "Three Data and One Chain" digital infrastructure, so as to build a long-term and stable governance system adapted to the development needs of the digital era, and provide dual guarantees of institutional norms and technical support for the inclusive and sustainable development of public sports services.

#### **5. Conclusions**

The EPS three-dimensional integration framework constructed in this study effectively solves the problem of theoretical fragmentation in the research on data-driven public sports service supply, by realizing the coordinated balance of efficiency, precision and sustainability three core value dimensions. The core theoretical and practical contributions of this study are reflected in three aspects: (1) It integrates the three conflicting theoretical paradigms of NPM, HEM and SIE into a systematic and operable theoretical framework; (2) It redefines sports data elements as relational

right bundles, and clarifies the transformation direction of the government's role from a traditional data controller to an agile governor; (3) It provides evidence-based and operable policy implementation paths for the digital transformation of public sports services. The practical application of the framework in typical Chinese cases fully verifies its effectiveness in optimizing the allocation of public sports resources and improving the equity of public service supply.

Future research can carry out long-term longitudinal tracking research on the implementation effect of the EPS framework in different regions, and conduct in-depth cross-country comparative studies combined with the practice of different countries. By adopting the EPS three-dimensional integration framework and the agile governance model, public sports service supply can better give full play to the core value of data elements, effectively support the implementation of national health strategies, and finally realize the inclusive and sustainable development of public sports services.

## References

- [1] Wang C, Wang X. Research on the Path of Embedding Digital Technology into Smart Community Sports and Elderly Care Services [J]. *Journal of Sociology and Ethnology*, 2023, 5(8): 45-58.
- [2] Lu L, Wei W. Contradiction between Supply and Demand of Public Sports Services and Coordination Strategies [J]. *Computational Intelligence and Neuroscience*, 2022: 1227981.
- [3] Li X, Guo X. Tripartite Evolutionary Game Analysis of Sports Data Rights Protection [J]. *Plos One*, 2023, 18(11): e0292914.
- [4] Aben T A E, van der Valk W, Roehrich J K. Managing Information Asymmetry in Digital Public-Private Relationships [J]. *International Journal of Operations & Production Management*, 2021, 41(7): 1145-1191.
- [5] Lusmägi P, Aavik K. Developing a Social-Ecological Model for Promoting Physical Activity Among Older Adults Based on the Experiences of 50+ Adults [J]. *SAGE Open*, 2021, 11(3): 21582440211032943.
- [6] Read D, Smith A C T. Data as Capital in Digital Sport Business Models [J]. *Convergence*, 2023, 29(5): 1389-1408.
- [7] Mou C, Cheng Y. Sports Industry Big Data Sharing on Cloud Platform [J]. *Security and Communication Networks*, 2021: 2824146.
- [8] Țicu D. New Tendencies in Public Administration: From NPM to E-Government [C]. *MATEC Web of Conferences*, 2021: 08002.
- [9] Zhang W, Mou C. Sports Industry Development and Public Health Strategy Under Low-Carbon Economy [J]. *Frontiers in Public Health*, 2023, 11: 1152452.
- [10] Bai Z, Bai X. Sports Big Data: Management, Analysis, and Challenges [J]. *Complexity*, 2021: 6676297.
- [11] Zheng L. Sports Teaching Innovation Based on Big Data [C]. *Journal of Physics: Conference Series*, 2021: 022023.
- [12] Chen B. National Fitness Marketing Strategy Based on Big Data [J]. *Applied Mathematics and Nonlinear Sciences*, 2024, 9(1): 6.
- [13] Liu Y, Wei W. KANO Model-Enabled Performance Evaluation of Urban Public Sports Services [J]. *Computational Intelligence and Neuroscience*, 2022: 1749616.