Data-Intelligent Governance of Public Digital Culture: Theoretical Foundations, Multidimensional Challenges, and Response Strategies[*]

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2026-07-24

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Abstract

The digital-intelligent governance of public digital culture is a governance innovation that takes data as a key factor of production, as well as a strategic deployment for advancing the modernization of national governance capacity in the digital-intelligent era. This article systematically reviews the evolutionary stages of the concept of digital-intelligent governance of public digital culture, reveals the shift logic of digital-intelligent governance, and, on this basis, distills four core logics. However, with the expansion of the instrumental value of technologies characterized by mechanical logic and efficiency supremacy, the digital-intelligent governance of public digital culture faces multidimensional challenges, including decision-making constraints, human-machine disconnection, collaborative barriers, and the digital divide. To effectively alleviate the tension between the ideal of technological empowerment and real-world governance contexts, this article proposes an integrated pathway framework for the digital-intelligent governance of public digital culture from four dimensions: factors of production, technological tools, organizational collaboration, and value ethics. It provides reference for promoting the digital-intelligent transformation of public digital cultural governance and facilitating the high-quality development of public cultural undertakings.

Full Text

[**Theory and Exploration**]

Data-Intelligent Governance of Public Digital Culture: Theoretical Foundations, Multidimensional Challenges, and Response Strategies*

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Abstract Data-intelligent governance of public digital culture is a governance innovation that takes data as a key factor of production, and it is also a strategic deployment for advancing the modernization of national governance capacity in the data-intelligence era. This article systematically reviews the evolutionary stages of the concept of data-intelligent governance of public digital culture, reveals the logic of the shift toward data-intelligent governance, and, on this basis, distills four core logics. However, as the instrumental value of technology—characterized by mechanistic logic and efficiency first—continues to expand, data-intelligent governance of public digital culture faces multidimensional challenges such as constraints on decision-making, human–machine disconnection, barriers to collaboration, and the digital divide. To effectively ease the tension between the ideal of technology-enabled empowerment and real-world governance con-

texts, this article proposes an integrated pathway framework for data-intelligent governance of public digital culture from four dimensions: production factors, technological tools, organizational collaboration, and value ethics. It thereby provides reference and inspiration for promoting the data-intelligent transformation of public digital culture governance and advancing the high-quality development of public cultural undertakings.

[**Keywords**] public digital culture; data-intelligent governance; conceptual evolution; internal mechanism

[**Chinese Library Classification No.**] G258.6 [**Document Code**] A [**Article No.**] 1003-7845(2026)03-0027-07

[**Citation Format**] Chen Ya, He Panpan, Liang Ying. Data-Intelligent Governance of Public Digital Culture: Theoretical Foundations, Multidimensional Challenges, and Response Strategies[J]. *Work of University Libraries*, 2026(3): 27–33.

Introduction

Data-intelligent governance of public digital culture is an important component and key lever of the national strategy to build China into a cultural power and of the strategy for cultural digitization; it is also an objective requirement for public cultural undertakings to actively respond to the development of big data and artificial intelligence[1]. Existing studies on public digital culture governance, data-intelligent scenarios, and public cultural governance oriented toward data-intelligent scenarios have laid an important theoretical and practical foundation for this field. However, as an emerging concept, data-intelligent governance of public digital culture is still at an initial stage in terms of theoretical construction and systematic analysis. To better integrate the data-intelligent functions established by intelligent technologies and digital transformation, and to promote the deep integration of data-intelligent technologies with public digital culture governance, this article systematically reviews the conceptual evolution stages of data-intelligent governance of public digital culture and the logic of the shift toward data-intelligent governance. It further clarifies its core logic and multidimensional challenges, and on this basis explores response strategies in depth, with a view to providing a certain degree of theoretically grounded reference for achieving a fundamental leap in the effectiveness of public digital culture governance, shaping a virtuous-cycle public digital culture ecosystem, and comprehensively promoting the high-quality development of public cultural undertakings.

1 The Theoretical Foundations of Data-Intelligent Governance of Public Digital Culture

1.1 Conceptual Evolution of Data-Intelligent Governance of Public Digital Culture

1.1.1 Public Cultural Governance Since "cultural governance" entered the field of Chinese academic inquiry, scholars, on the basis of critically absorbing Western theories and in combination with China' s institutional environment and social context, have refined the concept of "public cultural governance." In 2005, Luo Wei[2], when discussing the transformation of governmental management modes, referred to expressions related to "harmony in cultural public governance." Subsequently, Li Shaohui[3] and Wu Licai[4] took "public cultural governance" as an important concept for constructing a modern public cultural service system, and conducted preliminary explorations around the enhancement of public cultural governance capacity, related concepts, and the cultivation of publicness. In 2013, after the overall goal of "advancing the modernization of the national governance system and governance capacity" [5] was proposed, "public cultural governance" gradually became an important theoretical tool and practical pathway for promoting the development of nongovernmental organizations, analyzing cultural system reform, and seeking strategies for public cultural services. However, previous practice tended to emphasize governance instruments and infrastructure construction, without giving sufficient attention to the governance function of culture itself. As the national public cultural service system has basically achieved the goal of equalization and entered a higher stage of development, public cultural governance should realize the following transformations: first, a shift from basic governance to comprehensive governance[6]; second, giving play to the functions of public cultural governance, and optimizing the public life of the people through a modern public cultural service system[7].

1.1.2 Public Digital Culture Governance From the successive launch of the National Cultural Information Resources Sharing Project, the Public Electronic Reading Room Construction Plan, and the Digital Library Promotion Project, to the *Guiding Opinions on Further Strengthening the Construction of Public Digital Culture*

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* This article is one of the research outcomes of the major project of the National Social Science Fund of China, "Research on the Construction of a Public Digital Culture Governance System Oriented Toward Data-Intelligent Scenarios" (Project No.: 24&ZD182).

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Received: 2026-04-07 **Responsible editor:** Jia Nan

The promulgation and implementation of policy documents such as the *Ministry of Culture' s Plan for Cultural Reform and Development during the Twelfth Five-Year Plan Period* and the *Opinions on Accelerating the Construction of a Modern Public Cultural Service System* have, through a series of measures, charted a clear development path for the construction of public digital culture, reflecting a shift from a "construction logic" to a "governance logic." However, public digital cultural governance still has a long way to go in improving service levels, safeguarding citizens' rights and interests, and enhancing cultural influence.[8] Reliance solely on the spontaneity of digital culture and existing management models is no longer sustainable, and a more macro-level cultural governance strategy is urgently needed. To this end, scholars have conducted in-depth research on the subjects of public digital cultural governance,[9] governance effectiveness,[10] and capacity building,[11] yet problems such as an imperfect governance system and weak mechanisms for public participation remain. Research on public digital culture has not yet truly achieved a governance-oriented turn. Therefore, in the future, efforts should take high-quality development and the direct delivery of resources to the grassroots as goals, continuously explore institutional innovation, refine governance mechanisms suited to different regions, cultural types, and service needs, and enhance the intrinsic driving force of governance effectiveness.[12]

1.1.3 Digital-Intelligence Empowerment of Public Digital Cultural Governance

With the advancement of key projects such as the national cultural big data system, the smart library system, and the national public culture cloud platform, scholars have proposed concrete implementation plans for digital-intelligent transformation around smart library services,[13] public culture cloud services,[14] and library data culture.[15] However, these plans mostly focus on technical realization and business optimization, and have not fully responded to the governance needs of cultural data resources. Accordingly, China has proposed "building a cultural digitalization governance system," [16] exploring governance approaches that balance security and sharing. The *Overall Layout Plan for the Construction of Digital China* emphasizes "driving transformations in production, life, and governance through digitalization," [17] and puts forward systematic requirements for deepening the national cultural digitalization strategy. At present, digital-intelligence empowerment follows a progressive logic of "digitalization—intelligentization—deepening," aiming to move experience-driven resource management toward data-driven systemic governance.[18] Yet in practice it still faces challenges such as inconsistent data standards[19] and poor alignment between governance rules and technical systems.[20] Therefore, the Fourth Plenary Session of the 20th CPC Central Committee proposed "promoting the integration of culture and technology, and advancing digital-intelligence empowerment and informatization transformation

in cultural development," [21] requiring digital-intelligence empowerment to shift from improving local efficiency to strengthening systemic governance capacity, ultimately becoming a capability engine for reconstructing the cultural governance system and enhancing systemic resilience.

1.1.4 Digital-Intelligent Governance of Public Digital Culture

As an industry application of digital-intelligent technologies, "digital-intelligent scenarios" are an important engine driving the construction of public digital culture and governance innovation. New-generation digital-intelligent technologies such as artificial intelligence, virtual reality, and digital twins connect physical systems and digital systems in real time. They not only empower the intelligent development of public digital cultural governance, but also place new demands on digital-intelligent governance—namely, to break through the structural and deep-seated bottlenecks and obstacles in the construction of public digital culture and promote the digital-intelligent transformation of governance. To this end, the *Cultural Development Plan for the Fourteenth Five-Year Plan Period* calls for improving the level of public cultural digitalization,[22] while the *Opinions on Promoting the Implementation of the National Cultural Digitalization Strategy*[16] further provides overall arrangements spanning infrastructure construction, data circulation, full-chain services, and the governance system, so as to transform institutional advantages into governance effectiveness. Compared with the external tool-oriented positioning of "digital-intelligence empowerment," digital-intelligent governance of public digital culture emphasizes internalizing digital-intelligent technologies into the governance structure itself. In the process of conducting holistic governance of public digital cultural content, service modes, and business management based on multi-source heterogeneous cultural data, it focuses on the interactions among technology, data, rules, and people, aiming to form an adaptive and iterative new paradigm of cultural governance and to shape a public digital cultural ecosystem characterized by a virtuous cycle.

1.2 The Internal Mechanism of Digital-Intelligent Governance of Public Digital Culture

1.2.1 The Turn Logic of Digital-Intelligent Governance

In its traditional sense, "governance" carries meanings such as management, rule, and domination. In 1995, the Commission on Global Governance defined "governance," emphasizing more diverse subjects and richer principles, and the conduct of management activities through cooperation, voluntariness, consultation, and other means. In China, "governance" has been endowed with Chinese characteristics. In particular, after the proposal of concepts such as "social governance," "national governance," and "advancing the modernization of the national governance system and governance capacity," [5] it has placed greater emphasis on a pluralistic governance structure under the leadership of Party or-

ganizations.[23] Since the proposal of the Digital China strategy, China has accelerated its digital transformation, and digital-intelligent governance has been widely applied in fields such as urban operation, risk governance, and public services. As a product of the deep integration of digital-intelligent technologies and governance modernization, digital-intelligent governance has accelerated its integration with governance application scenarios, promoted the integration of various technological elements and innovation linkages, and facilitated the upgrading of governance concepts, organizational forms, and operating mechanisms into a smart collaborative model.

Related research has shifted from its initial focus on technological characteristics and their application potential[24] to revealing the deep transformation logic triggered by digital-intelligentization.[25] This transformation has occurred at multiple levels, including cognition, actors, pathways, and value, and is manifested as follows: at the cognitive level, digital-intelligent technologies drive decision-making from "experience-driven" to "data-driven," realizing the coordinated enhancement of instrumental rationality and value rationality; at the actor level, the structure of "one core with multiple actors" is maintained, the feature of "human–machine symbiosis" is highlighted, and the deep coupling and mutual shaping of technological intelligence and human cognitive capacity are pursued; at the pathway level, governance depends heavily on multi-dimensional and multi-level collaboration, the essence of which is to build a full-process, closed-loop collaborative governance ecosystem through the deep integration of digital-intelligent technologies and governance mechanisms; at the value level, efforts are devoted to creating an empowerment closed loop that optimizes effectiveness from individuals to institutions and then to the region as a whole, promoting a leap in governance effectiveness from local optimization to overall improvement.

1.2.2 The Core Logic of Digital-Intelligent Governance of Public Digital Culture

Digital-intelligent governance of public digital culture extends digital-intelligent governance into the field of public culture. Through the deep integration of digital-intelligent technologies and public digital cultural governance, it promotes a shift in governance from external empowerment to endogenous governance. On the basis of systematically reviewing the evolutionary stages of the concept of digital-intelligent governance of public digital culture and the turn logic of digital-intelligent governance, this article distills four major

core logic.

(1) The data-driven logic of cognition and decision-making. Decision-making in the governance of public digital culture relies on traditional experiential judgment or syntheses of existing research, whereas the digital-intelligent governance of public digital culture emphasizes data- and intelligence-driven restructuring, thereby promoting a profound transformation of the

cognitive foundation. Specifically, the digital-intelligent governance of public digital culture follows the cognitive chain of "data–information–knowledge–wisdom" [26]. With the aid of intelligent analytical technologies such as natural language processing, computer vision, and reinforcement learning, it extracts knowledge paradigms from multi-source heterogeneous data that are both deeply descriptive and operationally applicable. On this basis, taking data elements as the intermediary, the digital-intelligent governance of public digital culture conducts intelligent analysis and knowledge transformation on massive multi-source heterogeneous data, reconstructs the underlying basis of its decision-making logic, promotes the shift of governance logic from instrumental rationality to value-oriented comprehensive rationality, and realizes a leap from cognitive paradigms to decision-making logic.

(2) The bidirectionally reinforcing logic of "human–machine symbiosis." "Human–machine symbiosis" refers to the collaborative decision-making of human cognitive capacities and technological systems to jointly cope with the complex situations of digital-intelligent governance. This reconstructs the pattern of participation in the digital-intelligent governance of public digital culture, promotes the transformation of governance relations from "unidirectional control" to "human–machine symbiosis," and forms a bidirectional reinforcement mechanism. On the one hand, with the extension of the boundaries of digital-intelligent governance and the strengthening of the computing-power foundation, public cultural data and non-public cultural data are efficiently aggregated and integrated across domains. By absorbing new data sources and responding to environmental feedback from internal and external systems, technological systems continuously carry out algorithmic iteration and model optimization, improve the accuracy of forecasting public digital-cultural needs, and expand service functions. On the other hand, relying on value rationality and contextual understanding, humans formulate data-governance standards and technical norms, clarify innovation concepts and operating logic, and thereby build governance models and establish long-term operating mechanisms.

(3) The coupled logic of coordinated linkage. The full release and continuous improvement of the effectiveness of digital-intelligent governance of public digital culture depend on technological coordination within the endogenous public-cultural system and cross-domain collaboration with external systems. In terms of technological coordination, relying on open platforms and comprehensively applying digital-intelligence technologies such as big data, blockchain, and artificial intelligence, functional modules such as precise perception of demand, precise matching, and intelligent supply are integrated to build a whole-process closed loop of "perception–transmission–storage–computation–analysis–decision-making–execution," laying a technical foundation for digital-intelligent governance. In terms of cross-domain collaboration, it involves business linkage across departments, systems, and platforms, as well as multi-party collaborative participation.

Through the establishment of institutions such as user agreements, data-protection clauses, and trust mechanisms, the process alignment between internal and external public-cultural systems and the cross-domain flow of data elements are promoted, thereby constructing a governance ecosystem characterized by "government leadership, market participation, social coordination, and user benefit."

(4) The value-transition logic of "empowerment." Individual empowerment is the value cornerstone of the digital-intelligent governance of public digital culture. New forms such as immersive digital galleries, artificial-intelligence artistic creation, and virtual exhibition halls are reshaping the modes of public-cultural expression and the aesthetic ecosystem. Individuals are no longer merely recipients of services; they can also realize self-expression and the co-construction and sharing of culture through digital integration, thereby laying the capacity foundation for participation in governance. The digital-intelligent governance of public digital culture emphasizes a transmission mechanism from the micro level to the macro level. Through the connection, integration, and diffusion of digital-intelligence technologies, the leap in individual capabilities radiates to institutions and regions, converging into a driving force for cultural innovation and forming a progressive empowerment chain of "individual–institution–region." The "micro-innovations" of individuals and grassroots units are amplified and fed back through technological systems, in turn driving the continuous iterative optimization of resource allocation, service supply, and decision-making mechanisms. Thus, governance effectiveness moves from local optimization to overall enhancement, realizing a value transformation from "guaranteeing basic cultural rights and interests" to "empowering individual cultural subjectivity and social innovative vitality."

2 Multidimensional Challenges in the Digital-Intelligent Governance of Public Digital Culture

Along with the iterative upgrading of digital-intelligence technologies and the continuous advancement of digital-intelligent governance practices, while the digital-intelligent governance of public digital culture releases technological dividends, the "drawbacks" of technology have also become increasingly prominent. The value of technological tools, characterized by mechanical logic and efficiency supremacy, continues to expand, and its governance process is caught in a persistent tension between the ideal of technological empowerment and real governance contexts; it therefore faces multidimensional challenges.

2.1 Foundational Constraints on Scientific "Decision-Making"

When governance actors in the digital-intelligent governance of public digital culture make decisions, they are prone to constraints at three levels: data, technology, and cognition. At the data level, scientific decision-making must be

premised on authentic and reliable data. However, the multi-source heterogeneous data generated by digital-intelligence platforms are intermingled with large amounts of false and junk information, and hidden risks of information bias or human tampering also exist in the stages of data collection, entry, storage, and transmission. To screen out authentic and valid information, public cultural institutions have to expend substantial human, material, and financial resources on data verification. This not only results in inefficient allocation of public resources, but also causes governance decisions to lack timely and credible data support, ultimately affecting the timeliness and scientific nature of decision-making. At the technological level, the problem of the "algorithmic black box" weakens the transparency and explainability of decision-making. Some industry giants build exclusive competitive ecosystems through algorithms, data monopolies, and other means, thereby gaining discursive power in the industry. Relevant departments may easily develop rigid dependence on their technological tools, such as cloud services and intelligent recommendation algorithms, and thus gradually lose the capacity for autonomous judgment in decision-making. In addition, ossified algorithmic models give rise to path dependence in decision-making. Because actors' decisions often rely on inferences drawn from stock data, the inherent biases hidden in stock data can easily cause emerging cultural needs and the cultural demands of disadvantaged groups to be neglected, thereby departing from the orientation toward fairness and inclusiveness advocated by digital-intelligent governance. At the cognitive level, although digital-intelligent governance emphasizes unified rules and standardized processes, it has the limitation of being unable to adequately accommodate traditional governance experience, humanistic and ethical logic, and the complex real-world scenarios of grassroots governance. Because governance actors excessively follow system procedures and algorithmic outputs, they lack the capacity for autonomous adjustment in light of practical contexts. Once algorithmic bias arises, it can very easily induce decision-making failure and even trigger governance risks involving the alienation and abuse of algorithmic power [27]. The above multiple constraints

The accumulation of these factors has reduced the timeliness, transparency, and autonomy of decision-making, and has even weakened the social credibility of digital-intelligent governance of public digital culture.

2.2 The Sustainability Crisis of "Human–Machine Symbiosis"

In the process by which digital-intelligent governance of public digital culture moves toward "human–machine symbiosis," the core contradiction is manifested in a structural disconnect between governance subjects' technological cognition, decision-making flexibility, ethical judgment, and their capacity to adapt to digital-intelligent technologies. At present, large artificial intelligence models are growing exponentially, and concerns about "machines advancing while humans stagnate" have become widespread in the industry. It is believed that technology will gradually replace the human-led position in such core links as

cultural-content production, value discrimination, and ethical norm-setting. For example, intelligent recommendation algorithms and automated metadata indexing are gradually replacing traditional manual operations, weakening governance subjects' participation and discursive authority in operational processes. As digital-intelligent technologies become embedded throughout the entire process of public digital cultural governance, the opacity of algorithmic operations is impacting the system for defining governance responsibility. Meanwhile, new mechanisms for allocating rights and responsibilities adapted to "human–machine symbiosis" remain at the exploratory stage, and institutional norms are clearly lagging behind technological iteration. As a result, governance problems such as blurred boundaries of human–machine rights and responsibilities and difficulties in tracing responsibility frequently arise in digital-intelligent governance practice. Although the instrumental rationality of digital-intelligent technologies has improved the efficiency of public digital cultural governance, their excessive expansion is gradually dissolving the established ethical order of modern society. It has also severely compressed the flexible space for consultative governance originally built on interpersonal interaction, social consensus, and emotional communication, forcing governance subjects to strictly follow predetermined algorithmic rules and depriving them of the governance flexibility to respond adaptively and integrate reason with sentiment in face-to-face communication. For example, intelligent review models have replaced traditional manual rechecking, completely eliminating the communication and explanation link between governance subjects and the public. In sum, the structural disconnect between technological rationality and traditional humanistic governance not only greatly challenges the effectiveness of digital-intelligent governance, subject trust, and ethical norms, but also poses a new test for the dynamic adaptability of the existing digital-intelligent governance system for public digital culture.

2.3 Multiple Barriers Facing Collaborative Linkage

The "collaborative"linkage emphasized by digital-intelligent governance of public digital culture faces multiple barriers in practice. At the technical level, public cultural resources are characterized by multi-source heterogeneity and unstructured forms, while current digital-intelligent technologies remain limited in deep analytical capacities such as semantic analysis and knowledge extraction. They therefore struggle to fully parse the intrinsic semantic connotations of cultural resources, and even more to realize precise knowledge matching and intelligent association. This gives rise to certain semantic barriers between various public cultural institutions and digital resources, making it difficult to achieve deep data interoperability and resource linkage. At the level of institutional collaboration, because of differences in resource forms, metadata standards, and management mechanisms, public cultural entities such as libraries, cultural centers, and museums mostly operate independently. This results in insufficient integration in the interconnection, joint construction and sharing, and business linkage and collaboration of public digital cultural resources, making the phenomena

of "data islands" and "system islands" prominent and creating a governance dilemma of being "aggregated but not integrated." This greatly weakens the capacity of public digital cultural services for cross-domain collaborative linkage. At the level of security and trust, multiple technological risks are hidden in the supply process of public digital cultural services. First are technical security risks: because advanced data encryption, access control, and auditing functions are lacking, data may face the risks of illegal access and malicious destruction, and may even lead to adverse consequences such as leakage of users' personal information and abnormal service operation. Second are institutional risks: the iteration speed of digital-intelligent technologies far exceeds the speed at which governance rules are formulated, and the boundaries of rights and responsibilities in data governance among governance subjects such as governments, enterprises, and public cultural institutions are becoming increasingly blurred. This leads to unclear attribution of responsibility among governance subjects and the absence of accountability mechanisms, making it difficult to form an effective pattern of collaborative governance. In sum, multiple barriers involving technology, institutions, and security systems are intertwined, jointly hindering the full release of the value of collaborative digital-intelligent governance of public digital culture.

2.4 Multidimensional Digital Divides under Algorithmic Logic

Fairness and inclusiveness are among the core goals pursued by digital-intelligent governance of public digital culture, yet the multidimensional deepening of the digital divide poses certain challenges to this goal, which are manifested at three levels. First is the level of group bias. The operation of digital-intelligent platforms depends heavily on users' digital-intelligent literacy, and elderly groups are the primary victims. They commonly fear technology; moreover, platform algorithm design and interface interaction both take younger groups as their model and lack age-friendly design—such as cumbersome operations, small font sizes, and insufficient voice assistance—making it impossible for older people to use technological tools to obtain public digital cultural resources, and also difficult for them to express their own service needs. Second is the access divide. Constrained by the threshold for using digital-intelligent technologies and by imbalances in regional digital infrastructure, some digitally disadvantaged groups not only have difficulty accessing intelligent terminal devices but also lack basic digital operation skills. As a result, they face many limitations in technology application scenarios and cannot be included within the scope of public digital cultural services, thereby giving rise to group exclusion at the service level. Third is the level of urban–rural disparities. There is a conflict between the technological rationality of algorithms and the customs and human relationships of local society. Digital-intelligent systems tend to rely on standardized and quantitative models to process demand for public digital cultural services, but algorithms cannot effectively understand dialects and naturally have difficulty accurately identifying villagers' cultural needs. In addition, current algorithmic architectures and training data mostly come from urban sam-

ples, causing algorithms to struggle to accurately identify villagers' needs for public cultural services. Villagers thus tend to become marginalized in resource supply, which further intensifies the structural imbalance and digital divide in the allocation of urban and rural public digital cultural resources. The superposition of the above three digital divides continuously erodes the goal of fairness and inclusiveness in digital-intelligent governance of public digital culture.

3 Response Strategies for Digital-Intelligent Governance of Public Digital Culture

The above challenges show that digital-intelligent governance of public digital culture is not simply a technical issue. To effectively ease the tension between the ideal of technological empowerment and the reality of governance practice, it is necessary not only to rely on the endogenous evolution of technology and resources, but also to pursue innovation under institutional reconstruction and ethical adaptation. The following···

The comprehensive framework constructed from production factors to value ethics aims to promote the deep embedding of digital-intelligent technologies into governance fields, and to achieve a dynamic balance between instrumental rationality and humanistic values.

3.1 Production-factor layer: Activating the value and trust of data elements

Data are a key production factor in the digital-intelligent governance of public digital culture. Governance objects should not be limited to data themselves, but should also incorporate data rights, the role of production factors, and circulation-support systems. Governance methods should likewise shift from data management to factor operation, with coordinated efforts across the three dimensions of security and quality, trusted space, and semantic value, so as to achieve a dynamic balance between data security and the release of factor value.

First, the foundation of data security and quality must be strengthened. One aspect concerns privacy protection. Full-process privacy protection norms should be established: at the data-collection stage, users should be informed of the purpose, scope, and boundaries of use of data collection, and valid consent should be obtained; at the model-training stage, technologies such as federated learning and differential privacy should be used to make "data usable but invisible," avoiding direct exposure; at the application stage, data-access permissions should be strictly controlled, and emergency response mechanisms for privacy leakage should be established. The second aspect concerns data distortion. A full life-cycle data-quality management system should be established, introducing automated data-cleaning and correlation-comparison tools to distinguish the true from the false in massive heterogeneous public cultural data and non-public cultural data, remove false and junk information, strengthen the scientific basis of decision-making, and improve the efficiency of cultural-resource allocation.

Second, a trusted data space should be built. A trusted data space is a key infrastructure for resolving trust problems and activating the value of factors. Based on the public nature of public digital culture and the characteristics of data such as usability, trustworthiness, and circulability[1], governance rules and regulatory functions should be clarified. For example, cultural administrative departments should formulate rules for data access, use, and withdrawal. At the same time, through training and tool support, the capabilities of all stakeholders in data-quality identification and compliance control should be improved[2], thereby alleviating trust problems. On this basis, a value co-creation mechanism for data protection and benefit sharing should be promoted, clarifying the rules for benefit distribution and ownership among institutions, enterprises, and users. Through data-rights confirmation and value assessment, expected returns and responsibility boundaries should be clarified, willingness to share should be stimulated, "data islands" caused by insufficient interest incentives should be broken down, controllable and traceable cross-boundary circulation should be realized, and the "suspension" of data spaces should be prevented.

Finally, the deep semantic value release of "data elements +" should be driven. In view of the unstructured characteristics of public cultural data, semantic association and knowledge-graph construction should be strengthened. Ontology models should be combined with semantic-annotation technologies to conduct multidimensional, systematic processing by layers and structures[3]. Relying on knowledge graphs, and on the basis of prior standardized description and semantic association, knowledge reasoning should be used to mine implicit semantic relations contained in existing facts[4]. By combining user-behavior data and interactive feedback, and through knowledge extraction and precise matching, an intelligent supply model of "demand perception—precise matching—feedback loop" should be constructed, transforming fragmented public digital cultural resources into high-value knowledge assets, improving the intelligent level of public digital culture, and making data a core production factor that drives governance.

3.2 Technical-tool layer: Building resilient algorithms and smart infrastructure

The technical-tool layer is the carrier and core engine of the digital-intelligent governance of public digital culture. In response to the possible alienation of values caused by instrumental rationality, this dimension constructs a framework of collaborative evolution through the ethical embedding and full life-cycle supervision of "soft algorithms" and the field reshaping of "hard infrastructure," endowing the governance system with the capacity to generate flexible rules and to provide cross-domain collaborative services.

[1] 28
[2] 29
[3] 30
[4] 31

First, the generation of flexible rules driven by algorithms requires governance actors to reexamine the production logic of governance between instrumental rationality and value rationality. First, value judgments should be embedded in algorithms. In the stages of design and model development, efforts should be made to dissolve algorithmic bias and to implant core values such as fairness, urban–rural balance, and care for special groups into the underlying logic. Based on deep adaptation between digital-intelligent governance scenarios and user profiles, an ethical framework for value co-creation should be built. Second, full life-cycle supervision and management should be advanced. To address the problem of the "algorithmic black box," a full-process supervision mechanism should be established that covers data collection, algorithm design, model operation, and final result output, thereby improving algorithmic transparency. In addition, systems of prior ethical review and third-party dynamic auditing should be established to regularly inspect whether algorithmic systems deviate from established values and whether potential risks exist, so as to guard against technological alienation and hold the safety line. Third, the "explainability" of the decision-making process should be enhanced. Under a safe and transparent framework of ethical rules, algorithm controllers should clearly explain to users and regulatory departments the principles of the system, input instructions, operating environment, and the basis for output results. In addition, external professional institutions should be allowed to conduct fidelity reviews of source code, ensuring that automated decision-making conforms both to technical logic and to social justice.

Second, construction projects such as smart libraries and public-culture clouds should be continuously implemented to create smart infrastructure featuring cloud–endpoint integration and virtual–physical convergence. First, the construction of intelligent scenarios should be accelerated. Taking grassroots facilities such as county-level libraries, rural reading rooms, and cultural centers as fulcrums, county-level digital-intelligent experience centers should be established to empower the inclusive promotion and deep coverage of grassroots services, and to realize the integrated development of urban–rural smart services[5]. Second, the construction of public-culture cloud platforms should be coordinated and advanced. High-quality resources nationwide should be pooled, mainstream general-purpose and specialized large models should be connected, and a cloud-cluster system should be built that features logical semantic association, high-recall and high-precision retrieval, and open sharing across the whole domain[6], thereby realizing data circulation and collaborative governance across levels, systems, and business forms. Third, an intelligent and inclusive cloud-based digital-library and cultural-center main-branch service system should be constructed, turning the public-culture cloud into a public-culture large-model and intelligent-service platform. By using precise user profiles and intelligent association technologies, platform service functions should be continuously deepened, intelligent innovation models should be explored, and service supply should be

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[6] 32

enriched and precisely matched.

3.3 Organizational-collaboration layer: Reconstructing governance responsibilities and the collaborative framework

In the digital-intelligent governance of public digital culture, the key tasks of the organizational-collaboration layer are to clarify the boundaries of responsibilities in digital-intelligent governance, establish cross-institutional collaboration mechanisms, and cultivate shared governance with participation by multiple actors—

···driving the deep integration of digital-intelligent technologies and humanistic values, and providing institutional guarantees and organizational support for the sustainable development of public digital culture.

First, the boundaries of powers and responsibilities should be clarified. A reasonable allocation of powers and responsibilities can reconstruct governance subjectivity and promote innovation in the application of digital-intelligent technologies. Governance actors should possess ethical judgment, abductive reasoning in ambiguous situations, and the capacity to respond to emergence in nonlinear systems; they should retain the ultimate power of adjudication and be responsible for policymaking, process supervision, ethical balancing, and the institutionalized setting of key nodes. As enabling tools, digital-intelligent technologies undertake tasks such as data mining, pattern recognition, service push, and scenario simulation, thereby assisting humans in making efficient decisions. At the same time, the boundary between decision-making and technological assistance must be clearly defined, the principle that "humans are the ultimate subjects of responsibility" must be established to provide a backstop for outcomes, and a whole-process traceability mechanism must be built. Data from the entire process—including algorithm design, training, application, and decision-making —should be retained to ensure that, when errors occur, their origins can be rapidly traced and the decision chain restored.

Second, a cross-departmental coordination mechanism should be established. In response to the fragmentation of business processes and the ambiguity of responsibility division among institutions such as libraries, archives, and museums, an integrated governance platform with a command center as its hub should be built, and business processes and organizational structures should be adjusted. For the "middle zones" across institutions, fields, and levels, innovative application scenarios should be developed; data annotation paradigms should be reformed; and semantic networks with rigorous logical constraints should be constructed, covering core entities, events, and concepts and providing knowledge bases with identifiable sources. Through cross-modal association, entity mapping, and temporal deduction, fragmented information can be integrated into structured knowledge. Meanwhile, through the linked design of cross-domain scenarios, institutional barriers can be broken down, creating a connected and immersive experience for exploring cultural knowledge across

the entire domain[33].

Finally, a governance community characterized by multi-actor collaboration should be formed. The construction of a digital-intelligent governance knowledge system and the mining of the semantics of resources are, in essence, the systematic implementation of collaborative relationships among various governance actors[34]. First, governments and relevant functional departments should improve data governance systems and legal-regulatory frameworks, promote the circulation and sharing of cultural data through the dual constraints of institutions and the rule of law, and promptly update and refine ethical norms and codes of conduct so that the value logic of governance truly meets human developmental needs. Second, technology enterprises and platform operators should complete data aggregation and warehousing in accordance with unified standards and actively participate in the mining, analysis, and annotation of cultural data. Third, public cultural institutions should open up channels for public feedback, actively adopt user opinions, guide the public to participate deeply in the development of governance scenarios, and promote the deep integration of digital-intelligent governance tools with human-centered values. Fourth, grassroots social forces such as community workers and local worthies may rely on localized experience to accurately convey culturally distinctive local needs to technology R&D and governance departments, avoiding the homogenization of governance scenarios and enabling the effective adaptation of technological operating logic to regional cultural characteristics.

3.4 Value-Ethics Layer: Bridging the Digital Divide and Highlighting Inclusive Digital Intelligence

Inclusiveness and balance are important features of digital-intelligent governance for public digital culture, requiring the governance logic to shift from data-driven approaches to value ethics. To this end, it is necessary to horizontally bridge the digital divide affecting disadvantaged groups, vertically break through structural barriers between urban and rural areas, and, through literacy cultivation and empowerment, build an inclusive, shared, and sustainable digital cultural ecology.

First, the "digital divide" among disadvantaged groups should be bridged to highlight the inclusiveness of digital intelligence. The digital divide caused by technical thresholds is especially evident among special groups such as older adults and persons with disabilities, and has become a structural problem that cannot be ignored. Therefore, it is necessary to reduce technical thresholds and enhance their digital capabilities through information accessibility construction[35], "people-oriented" classified governance models, methods such as "letting data run errands instead of people" [36], and disability-adaptive renovation[35][37]. When designing smart terminals, special groups should be allowed to participate in the entire design process; intuitive graphics, voice interpretation, and other methods should be used as alternatives to purely numerical listings, so as to bridge gaps in digital-intelligent literacy. At the same time,

attention should be paid to their service needs, and digital-intelligent products that conform to their psychological and physiological characteristics should be designed, using digital-intelligent technologies to realize more intelligent and convenient interactive experiences.

Second, structural barriers between urban and rural areas should be broken through to promote balance. Rural areas—especially remote ethnic-minority areas and economically underdeveloped regions—are at the end of the governance chain. To promote public digital cultural governance in rural areas, institutional innovations such as the general-branch library system and rural reading rooms, mechanisms that deliver resources directly to the grassroots, and new types of rural public cultural spaces should be leveraged to smooth the "last mile" of grassroots services. Comprehensive thinking characterized by "top-level + bottom-level," "intelligent governance + self-governance," "decoding + translation," "online + offline," and "inclusiveness + sharing" should be used to promote the interaction of urban and rural resources[38] and improve overall efficiency. In addition, grassroots institutions should explore the deep integration of public cultural undertakings and industries, and create a distinctive model of "culture and tourism + rural revitalization" [39].

Finally, a compound talent echelon with digital-intelligent cognition and operational capabilities should be built, so that digital-intelligent technologies can be embedded into governance structures and become an important driving force for improving efficiency and stimulating creativity[32]. To this end, emphasis should be placed on the following three aspects. First, digital-intelligent awareness should be strengthened: digital-intelligent technologies should be recognized not merely as tools but as "new species" that reshape the rules of human existence. An open and inclusive attitude should be maintained; their performance and limitations should be understood objectively; fear should be eliminated; and, at the same time, security awareness should be established and privacy protection and risk prevention strengthened. Second, digital-intelligent knowledge should be updated: through education and training, basic knowledge of data, algorithms, artificial intelligence, and related areas should be learned, and methods for acquiring digital resources should be mastered. Third, digital-intelligent innovation capabilities should be enhanced: users should become proficient in the core functions and operational skills of digital-intelligent platforms and public cultural cloud platforms, adhere to their own subject position in cultural creation, actively participate—through digital integration—in the co-construction, co-governance, and self-expression of public digital culture, and improve their ability to use digital-intelligent technologies to govern public culture.

4 Conclusion

Digital-intelligent governance of public digital culture is an important component and key lever of the national strategy to build a culturally strong country and the cultural digitization strategy. Embedding digital-intelligent technolo-

gies into the field of governance alleviates the tension between the ideal of technological empowerment and real-world governance, and promotes the modernization of national cultural governance capacity. In essence, it is a deep-level paradigmatic···

pattern reconstruction. Looking ahead, such governance should move toward a dialectical unity of technological rationality and humanistic values, maintain theoretical self-consciousness and value clarity, eliminate structural and deep-seated obstacles during the transition period, shape a public digital-cultural ecosystem with a virtuous cycle, comprehensively promote the high-quality development of public cultural undertakings, and provide digital-intelligent support and practical reference at the level of cultural governance for the modernization of the national governance system and governance capacity.

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Research on the Construction of Foreign-Language Digital Resources in University Libraries from the Perspective of Information Foraging Theory: A Case Study of Capital Normal University Library

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Abstract Under the dual pressure of reduced funding and rising resource prices, the construction of foreign-language digital resources in university libraries is facing the severe challenge of how to "spend money where it counts most." This paper introduces information foraging theory as an analytical framework. Taking the library of Capital Normal University as an example, the journals in foreign-language databases are defined as efficient patches (frequently downloaded journals), restricted patches (frequently access-denied journals),

and inefficient patches (dormant journals). Through quantitative analysis and user interviews, the logic of user information behavior is deeply explored. The research findings are as follows: users' information foraging behavior exhibits significant quality-first and discipline-oriented characteristics, with both efficient and restricted patches concentrated in high-quality journals in science and engineering. There are structural differences in the information foraging strategies of user groups from different disciplines. There is a mismatch between the current resource map constructed by libraries and users' actual foraging map. Based on these findings, this paper proposes optimization strategies for the construction of foreign-language digital resources from five dimensions: optimization of information habitat structure, improvement of users' foraging ability, governance of the foraging environment, data-driven decision-making, and upgrading of library–vendor negotiation strategies, aiming to provide theoretical reference and practical guidance for precise resource procurement and efficient services in university libraries under budget constraints.

Keywords Information foraging; University library; Foreign-language database; Resource construction; Information behavior

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Digital Intelligence Governance of Public Digital Culture: Theoretical Basis, Multidimensional Challenges, and Coping Strategies

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Abstract Digital intelligence governance of public digital culture is an innovative governance model that prioritizes data as a key production factor, serving as a strategic deployment to modernize national governance capabilities in the era of digital intelligence. This article systematically traces the evolutionary stages of the concept of digital intelligence governance of public digital culture, reveals the transformational logic of digital intelligence governance, and distills four core logics. However, as the instrumental value of technology, characterized by mechanical logic and efficiency supremacy, expands, digital intelligence governance of public digital culture faces multidimensional challenges, including decision-making constraints, human–machine disconnect, collaborative barriers, and the digital divide. To effectively mitigate the tension between the ideal of technological empowerment and the realities of governance, the article proposes a comprehensive framework for digital intelligence governance of public digital

culture from four dimensions: production factors, technological tools, organizational collaboration, and ethical values, providing valuable insights for advancing the digital intelligence transformation of public digital culture governance and promoting the high-quality development of public cultural services.

Keywords Public digital culture; Digital intelligence governance; Concept evolution; Intrinsic mechanisms

Note: Figure translations are in progress. See original paper for figures.