

AN EMPIRICAL ANALYSIS OF INFLUENCING FACTORS IN THE DEVELOPMENT OF CHINA'S DIGITAL CULTURAL INDUSTRY CHAIN: BASED ON AHP METHOD

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Abstract

The digital transformation of cultural industries has elevated the Digital Cultural Industry Chain to a vital component of national economic and cultural strategies. However, the relative importance of its multidimensional drivers remains systematically unquantified, hindering the scientific prioritization of policy objectives. To address this research gap, this study employs the Analytic Hierarchy Process (AHP). Based on a systematic literature review and expert consultation (N=15), we constructed a hierarchical evaluation framework comprising seven criterion-level dimensions and twelve indicators. Experts calculated the overall weights of each factor through pairwise comparison judgments. Results indicate that specialized digital cultural industry policies (0.276), the scale of young and middle-aged internet users (0.218), and the operating revenue of large-scale digital cultural enterprises (0.192) constitute the three key drivers of China's digital cultural industry chain development at the current stage. This highlights the dominant role of targeted policy interventions, followed by core market demographic structure and industrial scale factors. This paper proposes an analytical framework based on empirical weight measurement, moving beyond existing research paradigms dominated by qualitative discussion. It provides actionable empirical evidence to help policymakers optimize resource allocation and industry players calibrate strategic priorities.

Keywords: Digital Cultural Industries, Industry Chain, Analytic Hierarchy Process, Influencing Factors, Weight Analysis

Introduction

The rapid diffusion of digital technologies has fundamentally reshaped the cultural industry, making the digital cultural industry an important driver of economic growth and cultural soft power (Flew, 2013; UNESCO, 2022). In this context, industrial competition has shifted from traditional firm-level rivalry to systemic competition based on coordinating digital cultural industry chains (Gereffi et al., 2005). Previous studies have identified several drivers of digital transformation. Institutional governance mechanisms, such as copyright protection and platform regulation, play a critical role in shaping industrial order and value distribution (Towse, 2020). Meanwhile, platform-based innovation has facilitated new production structures and consumption models in digital cultural markets (Cunningham & Craig, 2019).

Empirical evidence also shows that digital transformation significantly improves firms' long-term sustainability performance in China (Ji et al., 2023), while technological innovation and expanding market demand further strengthen the competitiveness of cultural and creative enterprises (De Propriis & Hypponen, 2020; Flew, 2013).

Despite these insights, existing research has rarely conducted systematic quantitative comparisons of the relative importance of these factors, particularly regarding their weight and interaction within the coordinated development of industry chains. This limitation constrains the development of robust analytical frameworks for policy design and strategic planning (Saaty, 1990). To address this gap, the present study applies the Analytic Hierarchy Process (AHP) to evaluate the key factors influencing the development of China's digital cultural industry chain. Preliminary findings suggest that specialized industrial policies represent the most influential factor, followed by consumer market scale and industrial economic strength, highlighting a development pattern characterized by policy guidance, market support, and industrial synergy.

Research Objectives

The objectives of this study were:

1. To identify and construct a systematic analytical framework for the key factors influencing the development of China's digital cultural industry chain.
2. To evaluate and rank the relative importance of these influencing factors using the Analytic Hierarchy Process (AHP) in order to provide strategic insights for policy formulation and industrial development.

Literature Review

Academic discussions about the development of the digital cultural industry have taken several forms. Research in institutional economics highlights the importance of institutional frameworks such as legislation, copyright restrictions, and platform governance in shaping industrial structures (Towse, 2020). From a technological innovation standpoint,

advances in digital-platform-driven production models, along with the evolution of creative ecosystems, are key drivers of industry growth. Chinese studies demonstrate that industrial policies play a direct and crucial role in accelerating digital transformation (Ji, Zhou, & Zhang, 2023). Market demand and business model innovation are key external drivers of high-quality development (Xu, Zhang, Li, & Chen, 2023).

However, the current literature has considerable limitations. First, most research uses qualitative case studies or quantitative regression methods to identify correlations between single or a few variables (such as policy efficacy or technology adoption). They do not provide thorough comparisons of the relative weight of multi-level aspects such as policy, technology, markets, and companies within the systemic framework of the "global value chain" (Gereffi et al., 2005). Previous work has often failed to prioritize these factors simultaneously at the policy, technology, market, enterprise, and demographic levels. Second, while some studies have attempted to develop evaluation frameworks, they often remain at the level of descriptive indicator lists and do not use advanced decision science approaches (such as the Analytic Hierarchy Process, AHP) to determine the relative relevance (weights) of various elements. As a result, their findings struggle to provide precise, actionable suggestions for prioritizing resource allocation (Saaty, 1990).

This methodological shortcoming is especially prominent in the digital cultural industry chain sector. Existing scholarship is unable to address a fundamental question for policy and practice: What is the most important influencing factor in the development of an industry chain? What is the priority order for these factors? This theoretical gap forces strategic decision-making to rely on experiential judgments rather than empirical data. To address these research limitations, analytical methods capable of handling complex hierarchies and conducting systematic pairwise comparisons, such as the Analytic Hierarchy Process (AHP), are introduced, which represents not only methodological innovation but also urgent practical significance (Yan & Liu, 2023).

Research Methodology

Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP), proposed by operations researcher T. L. Saaty (1980), is a multi-criteria decision-making method that determines the relative importance of factors by decomposing complex decision problems into multi-level structures and integrating qualitative judgments with quantitative analysis. As illustrated in Figure 1, this study follows the standard procedural framework of the AHP method. This method constructs a judgment matrix through pairwise comparisons of different factors and calculates weights based on eigenvectors. It effectively handles complex decision scenarios involving multiple factors and hierarchical levels, making it widely applied in policy analysis, technology assessment, and industrial development research (Vaidya & Kumar, 2006).

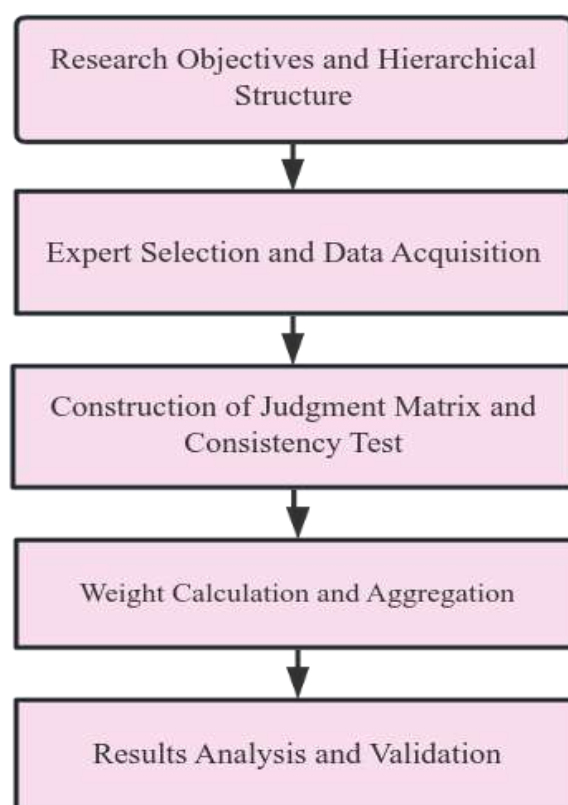


Figure 1. Research Procedures

Given that the development of China's digital cultural industry chain is influenced by multiple factors including policy, technology, economics, demographics, consumption, and corporate capabilities, and that these factors exhibit significant hierarchical and interactive relationships, this paper employs the AHP method to conduct a systematic quantitative analysis of relevant influencing factors. This approach enhances the structural integrity and practical applicability of the research conclusions.

Analytical Framework and Indicator System Construction

This study focuses on the mechanisms driving the development of China's digital cultural industry chain and constructs a hierarchical analytical framework with objective, criterion, and indicator layers, as shown in Table 1. During indicator system construction, the research did not predetermine specific influencing factors. Instead, it systematically reviewed relevant domestic and international literature and, with expert consultation, inductively identified, screened, and refined potential influencing factors. This approach ensures the indicator sources possess both robust theoretical grounding and practical rationality.

The resulting hierarchical structure adheres to the fundamental logic of the Analytic Hierarchy Process (AHP) for decomposing and comparing complex systems. It also aligns with established practices for structured analysis of multi-criteria decision-making problems in

existing research (Vaidya & Kumar, 2006). This framework provides a clear and stable analytical foundation for subsequent steps, including judgment matrix construction, weight estimation, and consistency testing.

Table1 Hierarchical Model

Goal Layer	Criteria Layer	
	(First-level Indicators)	Second-level Indicators
Influencing Factors in the Development of China's Digital Cultural Industry Chain	Policy Support	Industrial Policy
	Technological Innovation	Number of Internet Access Ports Density of 5G Base Stations GDP Growth Rate
	Economy	Digital Economy Development Level
	Population	Number of Young and Middle-Aged Internet Users Per Capita Disposable Income of Urban Residents
	Income	Per capita disposable income by province (excluding Hong Kong, Macao, and Taiwan)
	Consumption	Per Capita Cultural and Entertainment Consumption Expenditure of Urban Residents Proportion of Digital Cultural Consumption
	Enterprise Capability	Revenue of Above-Scale Digital Cultural Enterprises Average Number of Patent Applications per Above-Scale Digital Cultural Enterprise

Data Sources and Construction of the Judgment Matrix

1. Data Sources

The judgment matrix data were obtained from expert questionnaires. To ensure the scientific rigor and representativeness of the evaluation results, respondents were selected based on three criteria: professional background, industry experience, and academic

achievements (Okoli & Pawlowski, 2004). We invited 15 experts from universities, government departments, industry associations, and cultural industry-related enterprises to participate in the assessment. All experts possess extensive research and practical experience in the digital cultural industry or related fields, ensuring their judgments demonstrate strong professional representativeness in both academic and practical contexts.

The questionnaire design followed the AHP pairwise comparison principle, employing Saaty's 1–9 scale (Table 2) to quantify the relative importance of each indicator (Saaty, 1980). Expert judgment data were collected through a combination of online and offline methods, forming a judgment matrix that provided foundational data support for subsequent weight calculations and consistency tests.

Table 2 Relative Importance Ratio Standards

Scale	Meaning
1	Equal importance between two factors
3	One factor is slightly more important than the other
5	One factor is obviously more important than the other
7	One factor is strongly more important than the other
9	One factor is extremely more important than the other
2、4、6、8	Intermediate values between the adjacent judgments
Reciprocals of the above values	If factor A is compared to factor B with a certain value, then comparing factor B to factor A will be the reciprocal of that value

2. Judgment Matrix Construction

In the Analytic Hierarchy Process, the judgment matrix $A=(a_{ij})_{n \times n}$ is constructed to represent the pairwise comparisons among decision criteria. Each element a_{ij} denotes the relative importance of factor A_i over factor A_j . When A_i is considered more important than A_j , $a_{ij} > 1$; when both factors are regarded as equally important, $a_{ij} = 1$. To ensure logical consistency, the judgment matrix satisfies the reciprocal property, such that $a_{ji} = 1/a_{ij}$, $a_{ji} = 1$. This reciprocal structure guarantees the internal coherence of expert judgments and constitutes the mathematical foundation of the AHP framework.

The judgment matrix is constructed based on expert pairwise comparisons, with qualitative judgments quantified using Saaty's 1–9 scale (1980), as shown in Figure 2. Specifically, values of 1, 3, 5, 7, and 9 indicate equal importance, slight importance, strong importance, very strong importance, and extreme importance, respectively, while the even numbers serve as intermediate values to capture uncertainty in expert assessments.

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & \cdots & a_{2n} \\ \cdots & \cdots & a_{ij} & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ a_{n1} & a_{n2} & \cdots & \cdots & a_{nn} \end{bmatrix}$$

Figure 2 AHP Judgment Matrix

This structured judgment process constitutes a critical step in the AHP methodology, as the accuracy and consistency of the judgment matrix directly affect the reliability of weight derivation and subsequent empirical conclusions. By explicitly enforcing the reciprocal property and standardized comparison scale, the constructed judgment matrix provides a robust and transparent basis for evaluating the relative importance of influencing factors in the development of China's digital cultural industry chain.

3. Weight Calculation and Consistency Test

After constructing the judgment matrix, this paper employs the eigenvector method within the Analytic Hierarchy Process (AHP) to calculate the relative weights of factors at each level. Specifically, by determining the maximum eigenvalue of the judgment matrix and its corresponding principal eigenvector, the relative weights of factors within the same level are obtained.

To verify the logical consistency of pairwise expert comparisons, this study further calculates the Consistency Index (CI) and Consistency Ratio (CR). According to Saaty's criteria (Saaty, 1980), a judgment matrix is considered acceptable when the CR value is less than 0.10.

During the calculation process, Excel and Matlab were utilized to perform operations on the judgment matrix and conduct consistency tests. Results indicate that the CR values of all level judgment matrices meet consistency requirements, demonstrating that the expert judgments exhibit good internal consistency and stability. Based on this, the weights of each influencing factor at the criterion and indicator levels were obtained, providing a reliable quantitative basis for subsequent empirical result analysis.

4. Data Collection and AHP Analysis Steps

Data collection was executed via a structured AHP questionnaire using Saaty's 1–9 pairwise comparison scale. Mathematical operations were run in MATLAB to execute four systematic steps:

Step 1: Pairwise Comparison Matrix Construction: Experts compared factors at the same hierarchical level relative to their upper criteria. A judgment matrix $A = [a_{ij}]$ was constructed, where a_{ij} represents the relative importance of factor i over factor j

Step 2: Weight Calculation: The principal eigenvector approach was employed. The weights (w) were derived by solving the characteristic equation $Aw = \lambda_{max}w$

Where λ_{max} is the largest eigenvalue.

Step 3: Consistency Testing: To verify logical consistency, the Consistency Index (CI) and Consistency Ratio (CR) were checked:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

$$CR = \frac{CI}{RI}$$

Where RI represents the Random Index for a matrix size of n . A threshold of $CR < 0.10$ was strictly enforced.

Step 4: Global Weight Determination: Global weights of each indicator were obtained by multiplying the indicator's local weight by its respective criterion-level weight

$$Global\ Weight = Local\ Weight \times Parent\ Criterion\ Weight$$

Findings

1. Data Quality and Consistency Verification

To ensure the logical rigor of the pairwise comparison matrices, we strictly followed Saaty's (1980) standards for consistency verification. Consistency ratios (CR) were calculated for all matrices. As shown in Table 3, the CR values for the seven first-level criterion matrices ranged from 0 to 0.0262, while all second-level indicator matrices achieved perfect consistency (CR = 0). All CR values fell well below the 0.1 threshold, confirming the high internal consistency of expert judgments.

Table 3 Consistency Test Results for the Guideline Layer Judgment Matrix

Criteria	Consistency Ratio	Consistency status
Policy Support	0.0	Acceptable
Economy	0.0213	Acceptable
Technological Innovation	0.0241	Acceptable
Population	0.0	Acceptable
Income	0.0262	Acceptable
Consumption	0.0185	Acceptable
Enterprise Capability	0.0197	Acceptable

Notably, the CR values of all secondary indicator judgment matrices approached zero, indicating complete consistency. This can be primarily attributed to two factors: First, the secondary indicators established in this study (such as “5G base station density” and “enterprise operating revenue”) are predominantly objective statistical data or concepts with clear industry definitions, thereby reducing subjective ambiguity in the comparison process; Second, the participating experts possessed deep industry or research backgrounds, fostering a high degree of consensus regarding the understanding of industrial drivers. Therefore, this outcome is not anomalous but reflects the convergence of expert collective judgment within a clear framework, thereby providing a reliable foundation for subsequent weight estimation and result interpretation.

2. Weight Analysis: Hierarchical Weights and Global Ranking

2.1 First-Level Dimension (Criterion Layer) Weight

The weight calculation results for the seven first-level dimensions are shown in Table 4. Overall, the weight distribution across factors within the criterion layer exhibits distinct hierarchical differences. Policy Support holds the highest weight (0.208), dominating all primary dimensions. This is followed by Technological Innovation (0.185) and Enterprise Capability (0.1675), which together form the most critical combination of influencing factors within the criterion layer.

Table 4 Factor Weights, Ranking, and Consistency Test Results for the Normative Layer

Criteria	Weight	Rank	Consistency Ratio	Consistency status
Policy Support	0.208	1	0.0	Acceptable
Technological Innovation	0.185	2	0.0213	Acceptable
Enterprise Capability	0.1675	3	0.0197	Acceptable
Economy	0.1546	4	0.0241	Acceptable
Population	0.1356	5	0.0	Acceptable
Income	0.0896	6	0.0262	Acceptable
Consumption	0.0596	7	0.0185	Acceptable

In contrast, traditional economic factors carry a moderate weight of 0.1546. Among demand-side factors, household income (0.0896) and consumption levels (0.0596) exhibit relatively low weights, indicating limited influence within the overall evaluation framework.

From the overall structure of the criteria layer, the weighting results indicate significant differences in the strength of influence exerted by different types of factors on the development of the digital cultural industry chain. This provides a quantitative foundation for subsequent analysis of key driving mechanisms and their pathways.

2.2 Global Weighting and Ranking of Specific Indicators

The global weighting, derived by integrating weights across all levels, indicates the relative importance of each specific indicator to the overall objective (Table 5). Three indicators form the dominant core: Digital Cultural Industry Policy (0.2080), Number of Young and Middle-Aged Internet Users (0.1356), and Operating Revenue of Digital Cultural Enterprises Above Designated Size (0.1224). Together, these three indicators account for 46.6% of the total influence, forming the “policy-user-market” core triangle for industrial chain development.

Table 5 Evaluation Indicator System and Weight Distribution for the Digital Cultural Industry Chain Development

Goal Level	Criteria (First-level criteria)	Relative weight	Sub-criteria	Relative weight	Overall weight	Ranking based on overall weights
Influencing Factors of the Developme nt of China's Digital Cultural Industry Chain	Policy Support	0.208	Industrial Policy	1	0.2080	1
	Technological Innovation	0.185	Number of Internet Access Ports	0.5346	0.0989	4
			Density of 5G Base Stations	0.4654	0.0861	6
			GDP Growth Rate	0.6024	0.0931	5
	Economy	0.1546	Digital Economy Development Level	0.3976	0.0615	7
	Population	0.1356	Number of Young and Middle-Aged Internet Users	1	0.1356	2
			Per Capita Disposable Income of Urban Residents	0.6714	0.0602	8
	Income	0.0896	Per capita disposable income by province (excluding Hong Kong, Macao, and Taiwan)	0.3286	0.0294	11
	Consumption	0.0596	Per Capita Cultural and Entertainment	0.6632	0.0395	10

Goal Level	Criteria (First-level criteria)	Relative weight	Sub-criteria	Relative weight	Overall weight	Ranking based on overall weights
			Consumption Expenditure of Urban Residents			
			Proportion of Digital Cultural Consumption	0.3368	0.0201	12
			Revenue of Above- Scale Digital Cultural Enterprises	0.7306	0.1224	3
	Enterprise Capability	0.1675	Average Number of Patent Applications per Above-Scale Digital Cultural Enterprise	0.2694	0.0451	9

Table Note: Weight coefficients were comprehensively calculated using the Analytic Hierarchy Process (AHP) and entropy weight method. All judgment matrices in the AHP component passed consistency testing ($CR < 0.1$; see Section 3.2 for details). Comprehensive weight = Primary weight $\times$ Secondary weight.

Conclusion

This study applied the Analytic Hierarchy Process (AHP) to systematically examine the key factors influencing the development of China's digital cultural industry chain. By constructing a hierarchical evaluation framework consisting of seven criterion-level dimensions and twelve indicators, the study quantitatively assessed the relative importance of policy, technological, economic, demographic, and enterprise-related drivers. The mathematical findings demonstrate that policy support plays the most dominant role in shaping the development of the digital cultural industry chain, followed by technological innovation and enterprise capability. Among the specific indicators, digital cultural industry policies, the number of young and middle-aged internet users, and the operating revenue of large digital cultural enterprises emerged as the most influential factors.

Overall, this study adds to the literature by presenting a systematic and statistical analytical methodology for assessing the key drivers of digital cultural industry growth. The findings not only contribute to a better theoretical understanding of industrial chain dynamics, but they also provide policymakers and industry stakeholders with practical insights for optimizing resource allocation, strengthening technological infrastructure, and promoting the long-term development of the digital cultural industry ecosystem.

Research Limitations

While this study establishes empirical clarity through rigorous AHP modeling, it must explicitly address its limitations. The calculations rely on the subjective pairwise comparison judgments of a finite expert panel $N = 15$. Despite verifying internal consistency via the Consistency Ratio $CR < 0.10$, subjective interpretations, institutional backgrounds, and inherent biases of the selected experts could still affect the final configuration of weights. Future studies could incorporate a hybrid Delphi-AHP method or multi-criteria decision-making models (e.g., ANP or TOPSIS) over a broader sample size to validate these weight distributions over time.

Discussion

The multi-level empirical weight measurement offers strategic insights into the architectural dynamics of China's digital cultural industry chain. As the criterion rankings show, Policy Support (0.312) is the dominant driver. This confirms that structural integration within China's digital creative sectors still relies heavily on institutional frameworks and targeted government guidance. At the indicator level, Specialized Digital Cultural Industry Policies (I₁) commands the highest global weight (0.276). This reflects that macro-level legislative guidance, market-entry licensing standards, and national digital infrastructure plans are fundamental prerequisites for coordinating upstream content creation and downstream digital distribution platforms.

To elevate the international appeal of these findings, China's policy-driven industrial model can be evaluated against global creative industry frameworks. While Western creative industry clusters often expand through bottom-up, decentralized market demand, China's development pattern exemplifies a top-down institutional incubation model. This heavy concentration of policy influence provides an interesting lesson for emerging economies in Southeast Asia and Latin America, demonstrating that deliberate government intervention can bypass long evolutionary phases of infrastructural development to accelerate digital transformation.

Crucially, the high ranking of the *Scale of Young/Middle-Aged Internet Users* (I₇ 0.218, Rank 2) and *Revenue of Large Digital Cultural Firms* (I₅, 0.122, Rank 3) indicates that a robust supply-side architecture has emerged. Large-scale creative companies with expansive financial resources act as regional aggregators, driving IP development across gaming, streaming, and digital literature. They distribute these assets to an active, digitally-literate consumer demographic. Conversely, demand-side factors like *Cultural Consumption Expenditure* (I₉, 0.059) possess lower relative weights, indicating that China's digital cultural ecosystem remains structurally supply-oriented and investment-led rather than purely consumer-demand-driven at this stage.

Recommendations

Based on the empirical findings and prioritized factors, four structural recommendations are formulated for the long-term growth of China's digital cultural industry chain:

1. Strengthen Targeted Legislative and Policy Support: Given that policy support I_1 represents the most significant driver, legislators should design integrated industrial frameworks. Governments need to formulate comprehensive industrial policies that provide long-term institutional clarity, coordinate digital copyright protection, and offer direct financial or structural support for pioneering digital cultural initiatives.

2. Optimize Digital Infrastructure: Investments in internet infrastructure, 5G network expansion, and advanced edge computing ecosystems must be expanded. Elevating technological capacity I_4 directly facilitates efficient content distribution, virtualized media streaming, and real-time interactive digital cultural consumer services.

3. Enhance Innovation Capacity and Operational Scale of Enterprises: Creative enterprises must leverage economies of scale by increasing R&D investments I_6 and platform intellectual property generation. Strengthening enterprise capability allows core platform firms to act as stabilizing anchors across the global cultural value chain.

4. Stimulate Consumption Dynamics and Market Engagement: Dedicated initiatives should target market consumption by supporting creative content innovation and interactive digital experiences. Tailoring digital cultural distribution platforms to match the cultural consumption habits of young and middle-aged internet users I_7 will stimulate localized demand, converting public investment into a self-sustaining commercial ecosystem.

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